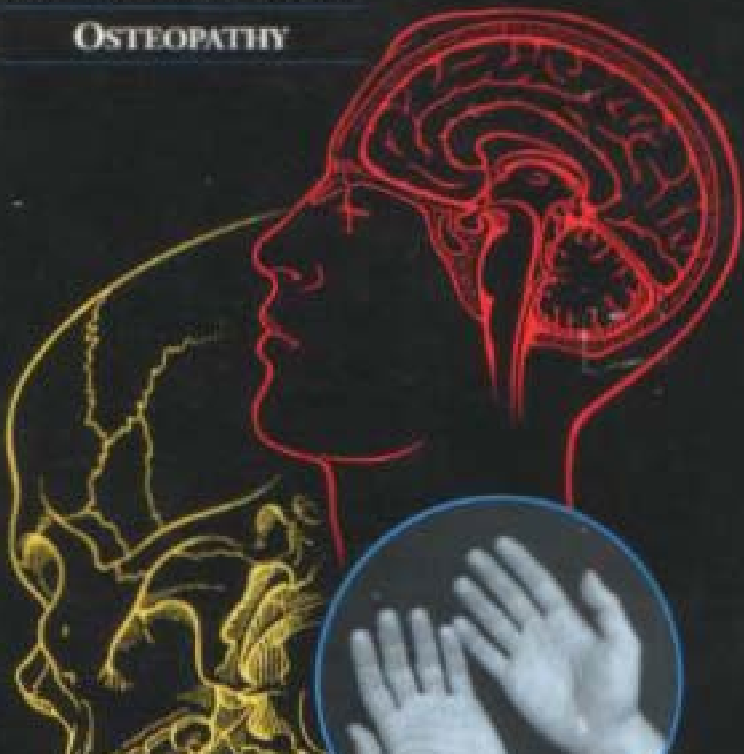
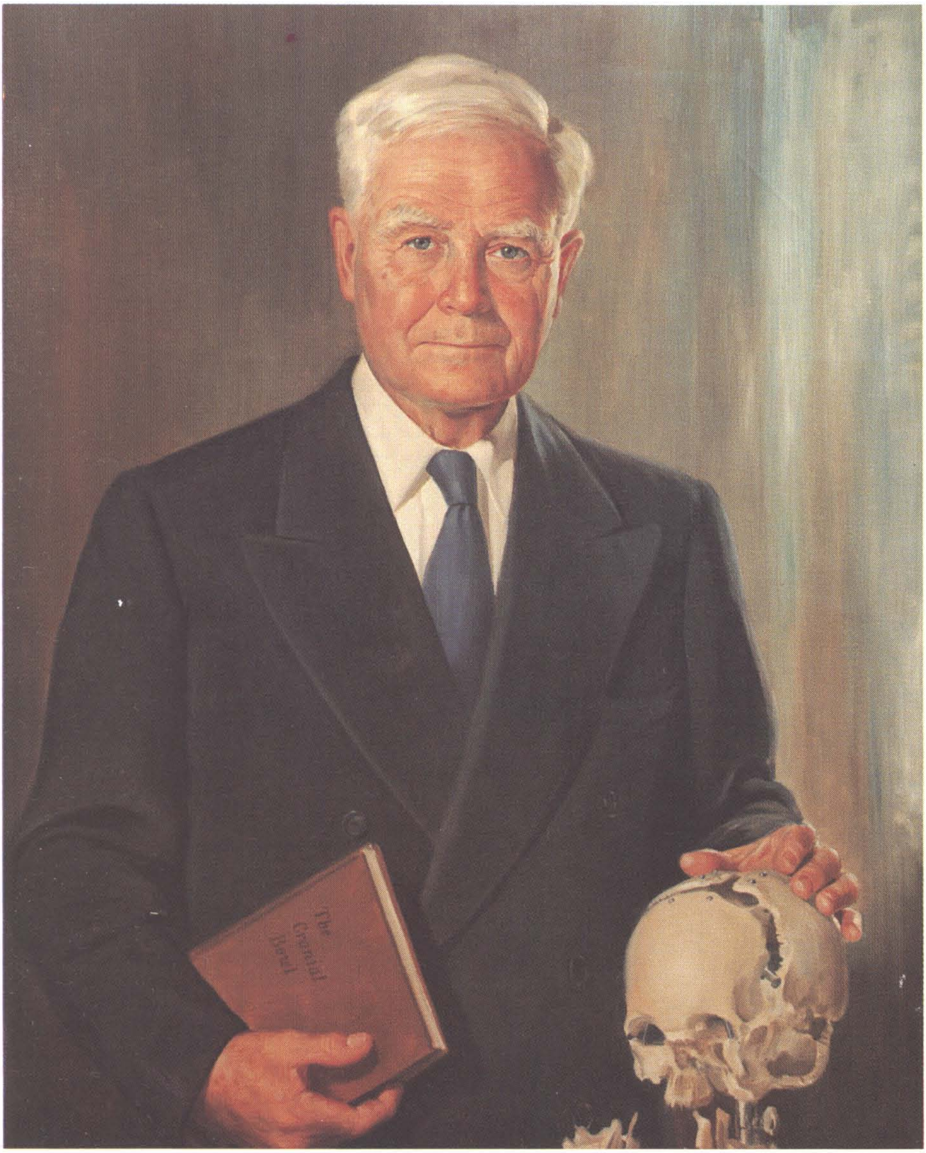
Teachings in the Science of Osteopathy



By William Garner Sutherland, D.O.

Teachings in the Science of Osteopathy

To Adah Strand Sutherland



William Garner Sutherland, D.O., D.Sc.(hon.)

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TEACHINGS IN THE SCIENCE OF OSTEOPATHY

WILLIAM GARNER SUTHERLAND, D.O.

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FOREWORD

Osteopathy in the Cranial Field

As envisaged by its founder, Dr. Andrew Taylor Still, the science of osteopathy includes a knowledge of philosophy, anatomy, and physiology for the whole body, together with their clinical application in both diagnosis and treatment.[1] *Osteopathy in the cranial field* is a part of this concept of total health care for all of the body physiology. Dr. Still, who was a frontier doctor, introduced the science of osteopathy in 1874 after long years of arduous study. The first school of osteopathy opened in 1892 in Kirksville, Missouri.

William Garner Sutherland was a student at this first school, the American School of Osteopathy. One day in 1899, during his senior year, he viewed a specially prepared and mounted skull. The intricate beveling displayed in the articular surfaces of the greater wings of the sphenoid and the squamous portions of the temporal bones, at the sphenosquamous suture, caught his attention. The thought struck him, "Beveled, like the gills of a fish, and indicating an articular mobile mechanism for respiration."

Dr. Sutherland spent the next thirty years working out the detailed anatomicophysiologic relationships of the craniosacral mechanism as he came to view it. Again, this view lay within the

1 For a general description of osteopathy and the life of Dr. Still (1828-1917) see: George W. Northup, *Osteopathic Medicine: An American Reformation* (American Osteopathic Association, 1979).

whole of the science of osteopathy as envisaged by Dr. A. T. Still. Dr. Still states in his writings, "All parts in the whole body obey the one eternal law of life and motion."

The cranial concept, as developed and taught by Dr. Sutherland, includes the following set of principles:

1. The fluctuation of the cerebrospinal fluid, or the potency of the Tide
2. The function of the reciprocal tension membrane
3. The motility of the neural tube
4. The articular mobility of the cranial bones
5. The involuntary mobility of the sacrum between the ilia

Dr. Sutherland named the integrated structure and function of these five components the *primary respiratory mechanism.* The presence of physiologic centers essential to life processes, especially the respiratory center, in the floor of the fourth ventricle accounts for his view of the whole mechanism as of *primary* importance. Dr. Sutherland considered the fluctuation of the cerebrospinal fluid to be the first and most fundamental feature in the primary respiratory mechanism.

The primary respiratory mechanism maintains an inherent, rhythmic, automatic, involuntary "life and motion" cycle of mobility and motility ten to twelve times per minute in health. This produces rhythmic flexion of all midline structures in the body with external rotation of all paired lateral structures, alternating with extension of all midline structures in the body with internal rotation of all paired lateral structures. Every cell and all the fluids of the body express this rhythmic, involuntary "life and motion" throughout life. This mobility and motility are important factors in maintaining health in the vital homeostasis of structure and function for the central nervous system, the endocrine system, and other units of function within body physiology.

Clinically, there are two basic types of mobility and motility in the total functioning of body physiology: voluntary and involuntary. The voluntary is that which we project through our sensory and motor input and output. The involuntary is even more remarkable in that it is strictly an activity of this flexion and extension for midline structures, and external and internal rotation for bilateral structures. It includes everything from fluids to soft tissues to the bony skeleton; in fact, it includes each and every cell in body physiology. Thus it is necessary to study the interrelationships of all these elements. Each individual portion of the anatomy and physiology is so designed and coordinated by its individual shape and contours that it manifests this rhythmic, alternating movement. The rhythmic movement of the involuntary mechanism is the same whether the body is at rest or in voluntary motion.

It is necessary for the physician to develop a thinking, feeling, knowing touch with which it becomes possible to restore the involuntary mobility and motility, and thus bring it to its full potential of function in the basic anatomicophysiology of health. As involuntary function restores itself, so does voluntary function.

Structural and functional problems within any part of the body can influence the primary respiratory mechanism. It is equally true that structural and functional problems in the primary respiratory mechanism can influence the rest of the body. It is a matter of the whole body in structure and function.

Osteopathy in the cranial field is applicable to all ages, from the newborn baby through to the aged. It can be involved in all the disciplines of medical science. It may be the primary health care needed for a specific trauma or disease, or it may be supplemental health care in a specific case that requires additional medical or surgical intervention. Problems that involve the cranial field itself obviously require a solution in that mechanism. In addition, there are problems arising elsewhere in the body physiology that are solved more easily when the cranial mechanisms are coordinated with other treatment.

There are many sets of principles involved in treatment programs for limitations of "life and motion" in trauma and disease. One of these principles was stated by Dr. Sutherland in 1947 when he said, "Allow physiological function within to manifest its own unerring potency rather than apply a blind force from without." His thought was specifically oriented for use in the craniosacral mechanism's patterns of health and disease, but it is also a principle that can be applied to the whole body physiology.

A physician or dentist interested in studying osteopathy in the cranial field would need to know the integrated philosophy, anatomy, and physiology of the primary respiratory mechanism as a background for developing palpatory and manual skills necessary for "reading" the rhythmic, involuntary mobility and motility of "life in motion" within the craniosacral mechanism and for their application in diagnosis and treatment potentials.

Rollin E. Becker, D.O.

PREFACE

THIS BOOK IS A compilation of lectures that were given by William Garner Sutherland, D.O., D.Sc.(hon.), to classes of instruction in Providence, Rhode Island. These classes were held in May 1949, May 1950, and June 1950, and included two introductory courses that were two weeks in duration and an additional study course on the occiput that was one week in duration.

At these courses, Dr. Sutherland presented at least one lecture each day. The remaining lectures were presented by members of his associate faculty, who also conducted the practice sessions that Dr. Sutherland arranged. He felt that it was necessary to transfer knowledge in the manual operations of osteopathy from "hand to hand." In order to provide this hand-to-hand instruction, each faculty member was assigned to coach four members of the class at the practice tables. During the practice sessions, each member of the class had the experience of being both the patient and the operator. The director of these classes in Providence was Chester L. Handy, D.O.

Over the years Dr. Sutherland held many classes at other locations. Although the directors of the classes and the members of the associate faculty present varied, the format was essentially the same. Dr. Sutherland also provided some teaching at his home and office in St. Peter, Minnesota, where he taught smaller groups under his own direction.

The members of Dr. Sutherland's associate faculty at the Providence courses were the following:

Chester L. Handy, D.O., Director
(1911–1963) Philadelphia College of Osteopathy, 1935.
Howard A. Lippincott, D.O.
(1893–1983) American School of Osteopathy, 1916.

Rebecca C. Lippincott, D.O.
(1894–1986) Philadelphia College of Osteopathy, 1923.
Anne L. Wales, D.O.
(1904–) Kansas City College of Osteopathy and Surgery, 1926.
Ward C. Bryant, D.O.
(1885–1975) Still College of Osteopathy, 1907.
Elsie W. Weeks, D.O.
(1891– ?) Massachusetts College of Osteopathy, 1922.
Edith Tordoff, D.O.
(?–1978) American School of Osteopathy, 1924.
Anna L. Slocum, D.O.
(1903–1988) Des Moines Still College of Osteopathy, 1938.

In 1939 Dr. Sutherland published a small book, *The Cranial Bowl*, which he wrote with the intention of stimulating inquiry from his colleagues. In due time it had its intended effect, and he was asked to present his thought at numerous meetings. An especially important presentation that opened a number of doors was the twenty-minute talk he gave at the meeting of the International Society of Sacro-Iliac Technicians in St. Louis, Missouri, in July 1940.[1] The title of that talk was "The Core-Link Between the Cranial Bowl and the Pelvic Bowl." After that there were many requests for instruction.

As Dr. Sutherland first introduced his teaching, he began with subject matter he believed would be most familiar to his professional colleagues. He then gradually introduced features of his thinking that he knew would be new to them.

Because so much of his writing and speaking was focused on introducing people to his ideas, Dr. Sutherland never wrote a formal, comprehensive statement of his cranial concept in the

1 The International Society of Sacro-Iliac Technicians was an informal organization of osteopathic physicians who met annually to explore new viewpoints and concepts in the field of osteopathy. In 1940 George W. Goode, D.O., was the president.

science of osteopathy. Many articles were written by his students as a result of the experiences they had using his teaching in their practices. Harold Ives Magoun, Sr., D.O., compiled and edited a text, *Osteopathy in the Cranial Field.* The text was a valuable addition to the teaching program because it permitted a change in the format of the classes, with a reduction in their length from two weeks to five days. A booklet, *Compression of the Condylar Parts of the Occiput*, was written by Howard A. Lippincott, D.O., and Rebecca C. Lippincott, D.O., in 1945. (Lectures by Drs. Howard and Rebecca Lippincott on this subject appear in this text.) While these works have been most helpful, they still do not constitute his own full statement.

The publication of these lectures by Dr. Sutherland is the nearest it is possible to come to a full statement of his concept and teaching. It does not contain everything that he thought or taught, but it is the most comprehensive presentation we have available to us.

In working with transcripts of lectures, it is clear that there is a difference between the spoken word and the written page that requires a kind of translation. In the process of making readable sentences, his spoken thoughts have been used carefully to be certain their meaning was retained. In addition, I have tried to retain the quality of Dr. Sutherland's way of expressing his thought in his teaching.

The editorial process also required the development of a format for the book. The subject matter from the transcripts was organized into chapters. In some instances, because of the nature of the material, there is some overlap and repetition. In other instances, it happened that he did not lecture on certain subjects, and in these cases I have used his written words instead. Where a lack exists it is because members of the associate faculty were assigned to present those subjects. The chief source of his written words is *Contributions of Thought*, which is a collection of Dr. Sutherland's writings from 1914 to 1954.

Also, in a few places in this current work, where background information was lacking, I have supplied it from various textbooks. In some cases anatomical terminology and spelling has been changed into modern form.

To elaborate on the description of many of the techniques mentioned in the text, an article entitled "The Osteopathic Technique of Wm. G. Sutherland" is included as an appendix. This article, written by Dr. Howard Lippincott, is reprinted with the permission of the American Academy of Osteopathy. I have also prepared a glossary to define unfamiliar terms and terms which Dr. Sutherland used in special ways. The illustrations for the text were conceived of by Rachel Brooks, M.D., and drawn by Marcia Williams of Newton, Massachusetts.

There are many fortunate events that have led to the publication of these lectures by Dr. Sutherland. First, there were two tape recorders running in the classroom in 1949 and 1950. Second, the recorded tapes were preserved and subsequently transferred onto cassettes. And third, friends transcribed his words from the cassettes and made the written transcriptions available to me.

In the fall of 1983 Dr. Rachel Brooks offered to transcribe several tapes on equipment that was available to her. The condition of the tapes made the work difficult, but her efforts resulted in transcripts with which to work. Then, in 1984, the Rev. Elyn MacInnis offered to transcribe more tapes, and finally her husband, the Rev. Peter MacInnis, added his efforts. In the end these friends provided me with all of this skillful assistance and transcribed all twenty-two cassettes.

Without this assistance the project could never have begun, and without considerable assistance it could never have been completed. Rollin E. Becker, D.O., and John H. Harakal, D.O., F.A.A.O., provided needed guidance and feedback about the project as a whole. Support for a variety of different technical aspects was given by James Gronemeyer, D.O., Duncan Soule, M.D., and Edgar Miller, D.O., F.A.A.O. A number of people contributed financially to the project based on their appreciation for the work of Dr. Sutherland. In particular, Swami Chetanananda generously made available significant publishing resources.

As the project moved along and each draft of the manuscript was completed, Dr. Harakal and Dr. Brooks provided thoughtful, critical comment. Finally, after my third draft, Dr. Rachel Brooks undertook the substantial task of getting the manuscript ready for the publisher. This included arranging for the book to be illustrated and helping to identify and correct the awkward and ambiguous passages. I wish to thank all these people who so freely gave so much of their time.

These lectures are for the work of the Sutherland Cranial Teaching Foundation, Inc. They do not constitute a textbook. *Osteopathy in the Cranial Field* by Harold I. Magoun, Sr., D.O., F.A.A.O., is the text used in the classes today. It is hoped, however, that this book in Dr. Sutherland's own words will be helpful in teaching, and useful to the reader in understanding, his cranial concept in the science of osteopathy.

Anne L. Wales, D.O.
Editor

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INTRODUCTION

It is possible to follow the course of Dr. Sutherland's thinking in the science and practice of osteopathy from his days as a student at the American School of Osteopathy in Kirksville, Missouri to the last lectures he gave at a seminar, again in Kirksville, in January 1953. This is so because Mrs. Sutherland wrote a biography of her husband, *With Thinking Fingers*, and collected his writings in another book which she entitled *Contributions of Thought.*

From this well-documented background it can be seen that Dr. Sutherland practiced as a physician and osteopath with what he had been taught. His understanding of what Dr. Still's teaching was, was sufficient to convince him that Dr. Andrew Taylor Still understood the living human body as a whole entity, a whole organism. He also realized that Dr. Still limited his teaching to what he thought the students of the first decade of the teaching of osteopathy could grasp and use intelligently. At the same time, he saw that Dr. Still planted the seed of the larger view in his teaching and writing. Naturally, Dr. Still expressed his understanding of the anatomy of the skeletal system and the concept of osteopathy in the language of his day.

Dr. Sutherland often said that the cranial concept was not his, but Dr. Still's. Dr. Still had stated that there are no synarthroses in a healthy living human body. At the time it was believed by most that the sacroiliac joint was a synarthrosis and therefore had no movement. In his teaching Dr. Still only emphasized the analysis of the sacroiliac joints, however Dr. Sutherland later realized that this applied to the bony cranium as well.

Dr. Still spoke often of the design for motion in the articulations of the bones. Because of this emphasis, anatomical specimens were on view at the college where the students could study them. Had this not been so, Dr. Sutherland would not have come to that moment in his life when he experienced a flash of insight which saw the articulation of the sphenosquamous suture as a design for motion that implied a respiratory mechanism, "like the gills of a fish." Given the statements in anatomical texts that the sutures and other articulations of the cranium and face fuse, or ossify, in the adult, he had much skepticism and reservation about his own insight for years.

Eventually, in an effort to resolve the uncertainty by getting the facts clear in his mind, Dr. Sutherland undertook a study of the articular surfaces of the individual bones to prove to himself that mobility between the bones of the cranium at the sutures was impossible. He was unable to do this and therefore had to confront the fact of a mobility that has no muscular agencies to account for the motion.

He says in his lectures that anyone else undertaking the same study will probably have the same shocks of understanding the reality that he had. This kind of study of the mechanics of articular mechanisms in the living human body led him to recognize powers within his patients which could resolve problems and heal strains. The nature of articular mechanisms in the endoskeleton, the mechanical principles related to their problems, and self-correction of such problems led to the invention of ways to diagnose and treat patients.

From this growth in his understanding of the science of osteopathy as it had been taught and envisaged by Dr. Still, came his invention and development of his skills as a physician. Based on what he learned from his patients, Dr. Sutherland developed many ways of practicing osteopathy. When he found that at the least his patients benefited from his treatments and at best got well, he considered that he was utilizing a profound science which just kept unfolding its truths. He had the skill as a physician to find the correct problem. He said in lectures that it is the diagnosis that is difficult. Once you understand that, the treatment is easy.

Many of his colleagues undertook to study with him because they wanted to learn to practice osteopathy as he did. That desire accounts for the classes which he taught during the 1940s and 1950s. It also accounts for the associate faculty which he trained.

Almost everyone who undertook this study felt the need to review their knowledge of anatomy and physiology. They found it easier and more interesting to study together. In consequence many study groups appeared around the country, and some of them decided to concentrate their attention on the cranium and Dr. Sutherland's teaching.

Most of the members of the classes studying with Dr. Sutherland were members of the Academy of Applied Osteopathy and this organization was a source of support for his teachings. In July 1946, a group of those interested assembled at the convention and scientific seminar of the American Osteopathic Association in New York City. Out of this meeting came the impetus to create the Osteopathic Cranial Association as an affiliate of the Academy of Applied Osteopathy.[1] The organization process was completed at the annual meeting in Chicago, in July 1947.

The Osteopathic Cranial Association's work included the organization of conferences and the development of materials for publications and the Cranial Study Groups. Throughout this time, Dr. Sutherland's teaching program was on-going and

1 At the time Perrin T. Wilson, D.O. and Thomas L.
officers in the Academy of Applied Osteopathy, and they were able to help to create this opportunity for Dr.

included the use of the facilities at the Des Moines Still College of Osteopathy and at the Chicago College of Osteopathy.[2] In addition, Dr. Sutherland traveled to regions that were convenient for those who wished to study his cranial concept. The classes held in Providence, Rhode Island in 1948, 1949, and 1950 were among those regional courses.

As time went on, Dr. Sutherland realized the need for some arrangement that would allow his teaching program to continue under his associate faculty. The arrangement he made was the incorporation of the Sutherland Cranial Teaching Foundation in Denver, Colorado in September 1953.

The Sutherland Cranial Teaching Foundation, Inc. is an educational organization whose purpose is the continuation of Dr. Sutherland's organized teaching program. In 1960 the Academy of Applied Osteopathy reorganized and changed its name to the American Academy of Osteopathy. At the same time the Osteopathic Cranial Association changed its relation to the Academy from affiliate to component and changed its name to the Cranial Academy.

The membership in all of these organizations has one thing in common: the continuing study of the science of osteopathy, and the development of further skills in its practice. There are publications, study groups, seminars, and conferences as well as programs that provide for visiting clinicians at the colleges of osteopathic medicine and at osteopathic hospitals.

The Sutherland Cranial Teaching Foundation teaches and trains members of the medical and dental professions in the

2 Beginning in 1944, Paul E. Kimberly, D.O., professor of anatomy at the Des Moines Still College of Osteopathy, arranged for the college facilities to be available for Dr. Sutherland to conduct classes in "Osteopathy in the Cranial Field." At the courses Dr. Kimberly reviewed the anatomy of the human head. The first members of the associate faculty were Raleigh S. McVicker, D.O. of The Dalles, Oregon and Beryl E. Arbuckle, D.O. of Philadelphia, Pennsylvania. After that beginning the associate faculty that Dr. Sutherland trained to assist in the teaching was gradually increased.

details of the philosophy, anatomy, and physiology of the primary respiratory mechanism. The teaching also trains members of the classes in palpatory and other manual skills used in clinical application of the cranial concept to health, as well as to problems of disease and trauma which affect the primary respiratory mechanism. Coordination with the anatomy and physiology of the whole body is emphasized.

Anne L. Wales, D.O.
Editor

* * *

William Garner Sutherland
Biographical Information

William Garner Sutherland, D.O., D.Sc. (hon) (1873 – 1954) was born in Portage County, Wisconsin. He lived with his family in Minnesota, and later moved with them to South Dakota. While in Blunt, South Dakota he became a "printer's devil" for the local newspaper, the *Blunt Advocate*. By 1890 he had worked his way up to being the foreman. In September 1893 he went to Fayette, Iowa to attend Upper Iowa University. After this he returned to newspaper work and eventually became the editor of the *Daily Herald* in Austin, Minnesota. While in this position, in 1898, he heard of Dr. Still and his teaching of osteopathy in Kirksville, Missouri. That year he entered the American School of Osteopathy and graduated with the class of 1900.

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TEACHINGS IN THE SCIENCE OF OSTEOPATHY

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ONE

Obtaining Knowledge versus Information

HAVE YOU EVER HAD a thought strike you? I have told many times of the thought that struck me before I graduated from the American School of Osteopathy with the class of 1900. As I looked at a disarticulated mounted skull that belonged to Dr. Still, the detail in the articular surfaces of the sphenosquamous sutures caught my attention. I became impressed with the idea that this suture was a display of a design for motion.

The squama of the temporal bones looked so much like the gills of a fish that the next thought seemed only logical. It struck me that this design for motion must represent a function. Thus I came to the thought that this function must be a respiratory mechanism. If you read the writings of Dr. Andrew Taylor Still carefully, even between the lines, you will find that his thinking was along these same lines. You will find that the cranial concept in the science of osteopathy was his, not mine.

The *science of osteopathy* came to Dr. Still in one of the saddest periods of his life. A prayer went out to his Maker for Guidance. That is where osteopathy came from, the Master Mechanic. That is the point of reference in all of his writings. He asked, "How old is osteopathy?" He answered, "As old as the cranium itself." He said that the science of osteopathy came, as have other truths, to benefit mankind.

The thought that came to me, "beveled like the gills of a fish and indicating a *primary respiratory mechanism*," not only struck me, it stayed with me. That is how I came to undertake a study intending to prove to myself that mobility between the cranial bones in the adult is impossible. Although it was recognized that there are no established joints at birth other than the occipitoatlantal joint, all the anatomical texts of the day said that the sutures fuse or ossify once the adult body is grown. There are many in the profession who are skeptical about this mobility. They are no more skeptical than I was in the beginning.

I began my study with the skull of a human skeleton I had in my possession. Fortunately, it was a more normal head than many now available. I became like a watchmaker in developing a delicate technique. I learned to take things apart from the articulated skull and put them together again after I came to understand the mechanism.

The day came when I sent a paper I had written to a professor at the college in Kirksville for review. His reaction was prompt. He said that the bones of the skull cannot be pried apart with a crowbar. That certainly does say that the human cranium is stable in its protective service. However, at the time when I received that reply I already had in my possession two little temporal bones, including the petrous portions, that I had been able to remove from an articulated skull specimen with the small blade of a penknife.

I agree, they couldn't have been pried out with a crowbar. That would have been too big an instrument for the delicate mechanism. If you understand the mechanism there are wonderful possibilities in store for you. Those who have yet to investigate it are missing out. If I had not had to stick my own nose down and dig, I would probably be skeptical today.

I had to perform many serious experiments on my own cranium because of my skepticism about the mobility of the cranial bones. I could not perform these experiments upon the heads of other people. However, I did need to perform them on a living head because it was necessary to have the knowledge that is unobtainable from the study of a dead specimen in an anatomical laboratory. I had to gain knowledge of many things in order to prove that motion between the cranial bones in the living adult is impossible. Had I tried them on another person I would only have had information; they would have had the knowledge.[1]

My mission has been *applied anatomy*. The information that I found in books gave me direction and many clues. It was important to find the statement that all the physiologic centers are located within the floor of the fourth ventricle, including that of respiration.[2] I realized that this floor was the medulla oblongata and also that the ventricle has a roof as well as a floor. I had a clue and information to start with in the phrase, "including that of respiration." So, that is where I went to find something simple regarding a *primary respiratory mechanism* of the living human body.

I gained the knowledge that included the Tide and something within that I call the "Breath of Life," not the breath of air. I failed to prove that there is no mobility between the bones of the living human cranium at the sutures in the adult, but I had to dig for knowledge of articular mobility in the skull and for knowledge of the primary respiratory mechanism.

I went back to the prenatal period in my studies to learn about the formation of bones. Osseous tissue is held together by membrane and cartilage and so arranged that the infant head can adapt to the maternal passageway. The parietal bones can fold over the frontal and occiput and between the temporals for an easier passage into the world. Can anyone doubt that there is movement at that period? The bones do not have articular

1 The experiments are related in detail in Dr. Sutherland's biography: Adah Strand Sutherland, *With Thinking Fingers, The Story of William Garner Sutherland, D.O.* The Cranial Academy, 1962.

2 "In the floor of the fourth ventricle . . . are situated certain important centres, i.e. cardiac, vasomotor, respiratory, vomiting, and deglutition centres." Samsom Wright, *Applied Physiology* (London: Oxford University Press, 1928), p. 108.

mobility but they do have movement. The normal cranium in infants and children provides for growth but you do not find significant articular gears forming until the age of ten, except a little here and there. After ten and through adolescence the articular gears form along with growth up to the mature anatomy in the adult.

When you begin to search later on in life you begin to read something about the different types of gears that have appeared. There is beveling, both internal and external, with opposite articular contact, signifying gliding mobility. There are also corrugations running transversely, diagonally, and so forth. Sutural arrangements display worm gears, cone gears, compensating gears, cryptic gears, friction gears, and screw gears. You find articular arrangements such as ball and socket, ball bearing, ball crank, box coupling, pit or pulley, counter shaft, and even a cradle. Equalizing bars, escapements, flexible shafts, force pumps, governors, jiggers, and the fulcrum are also found.

Then you wonder at what you see when you look at some of these anatomical specimens, articulated and disarticulated, of any age after the gears have begun to form. The variables in detail when the skull has grown with an unsymmetrical warp are amazing. These pathological specimens provide a background for understanding what you find in some of your patients. Some "bent twigs," as I call them, began in a malalignment shortly after birth, even perhaps prenatally, and grew as they could. It is not the ideal picture of the normal human head, mechanically speaking, but it has functional capacity and it is functioning — that is, until growth meets resistance and finally results in dysfunctions somewhere. It will be necessary to stretch your imagination many times in order to understand the normal for your patient.

The perfect anatomical picture is a necessary background for understanding what you see in many living heads. It is a process, and it is simple if you look and feel with an understanding of what adaptations are possible. The goal with your patients is to find the way to healthy function within the mechanism that they bring to you. You need the perfect mental picture to guide you, but it is not beneficial to undertake to impose the ideal upon the head as you find it.

When you study the sacrum suspended beneath the ilia by ligaments, you find indications for an articular mobility that is different from the postural mobility of the ilia upon the sacrum. Then you think of the sphenoid suspended beneath the frontal bone, and you begin to experiment. I found that placing a little pad under the apex of the sacrum when I was supine would throw the sacrum into its flexion position.[3] Then, I could move the pad up to the base and throw it into its extension position. Next, I found that if I left that pad down there I would find something occurring up in the head that showed the connection between the sacrum and the normal fluctuation of the Tide. Knowledge gained; it was not just information.

Learn to carefully scrutinize the information about the cranial field, and the cerebrospinal fluid in particular, so as to criticize scientifically. Do not base your thinking on matters that have been passed down through the ages without critical scrutiny. Study the animate human body as well as the cadaver. Study the life principle and come closer to understanding what I mean by the "Breath of Life." Dr. Still did his very best to introduce us to this phenomenon, but we were not ready for it.

Can you see the physiologic functioning in the posterior cranial fossa? Can you visualize the primary respiratory mechanism in conditions around those centers in the medulla oblongata? Here is a demonstration. The patient is supine on the table. My hands are under the occiput and temporal bones. My fingers are interlaced under the pons. If I am standing, my arms represent

3 In this concept, Dr. Sutherland references the position of the sacrum between the ilia to the position at the sphenobasilar junction in the cranial base.

the cerebellum. I bring my arms up together so that the fourth ventricle will be reduced in size, thus modifying dilation. Do you see a contracting motility in the cerebellum, the brachium pontis, the pons, and the fourth ventricle? I learned of that by performing many experiments upon my own human frame. Can you see that the motility in the brain stem in this way is the operation of the primary respiratory mechanism?

I found out how to spring the edges of my own supraocciput medially by using a catcher's mitt. I took two mitts, one left-handed and the other right-handed, laced them together at the ends, and placed a buckle on one and a strap on the other. I put them together in a sort of V-shape so that the supraocciput, at the outer edges, merely rested on the V. Then I drew up the strap through the buckle so that I could gradually increase the tension. Below the change of beveling in the lambdoidal sutures, the edges are beveled externally. The cerebellum is located in front of the supraocciput. What is happening to the cerebellum when you spring the edges of the occipital squama toward each other? What is happening to the pons, the medulla, and the fourth ventricle when the cerebellum changes its shape because the edges of the supraocciput are sprung? I gained some knowledge one day when I did that experiment on my own head.

On that day I went so far that I didn't know whether I would get back again. In answer to a question about that I will read a little saying that was sent to me on my seventy-seventh birthday. "The great secret, you see, is not to think of yourself, of your courage or despair, of your strength or your weakness, but of Him for whom you journey." I have told you that this is my mission. I had to be doing this. Then you will understand that He cannot show you a task without making you capable of fulfilling it.

There I was, pretty far out, trying to get some knowledge of what this mechanism is. I found out, but how was I to get out of it? I managed to get that device released, in some unknown manner. When it released there was a sudden sensation of warmth throughout my supraocciput. I also became aware of the movement of my cranium, the movement of the sacrum, and the fluctuation of the cerebrospinal fluid, the fluctuation of the Tide.

I could go on and on telling of the experiences I have had, what they might be called, and what can be learned from them. After learning of the primary respiratory mechanism, I undertook to devise experiments duplicating the effects of traumatic events as precisely as I could. One left me ready for a stay in a mental hospital. I found a way out of that condition, too.

Before I tell of one early experiment, let us consider the cranial bowl. In one anatomical text it says that the bones of the base of the skull are formed in cartilage and the bones of the vault are formed in membrane. When you look at the base of the cranium that ossifies in a cartilaginous matrix, you reason that if there is mobility between the bones of the base, there must be mobility between the bones of the vault. If you put a cap on there that ossifies in membrane, there must be some compensation to the mobility of the base or there would be interference in the action. The particular dovetailing in the sagittal suture of the vault shows the evidence of such compensation.

Look at the parietal bones, for example. There are two walls in the adult with diploe between them as well as the dovetailing in the sagittal suture between the two bones. The diploe within the vault bones is part of the blood vascular system and the parietals themselves are flexible in addition to their mobility in relation to each other at the suture between them. I realized that I could not physically touch the cranial base in the same sense that I could not touch the bodies of the vertebrae. It is possible, however, to have knowledge of the vertebral body based on the vertebral contacts that are accessible. Therefore, it seemed reasonable to suppose that I could feel the position of the bones of the base of the skull through the use of experiments on the vault.

I sought some kind of mechanism through which I might perform what I call the inhalation position of the sphenobasilar junction. I found a football helmet in a sporting-goods store. I took off the appendages — cut them right off. Then I hunted for a choice piece of chamois skin, something that would not stretch or pinch. When I had the helmet fitted on top of my head, I put a bandage about two inches wide around it, leaving two extensions that could be run up over the helmet. I fastened the ends with hemostats so that I could roll the bandages and clamp it. Visualize the bandage around and beneath with the extensions coming up and over. As I turned the hemostats, the helmet would lift the parietals laterally and upward. Then I would release the tension. I would turn the cranium into the inhalation position. I did not need to do anything to prove the extension position in exhalation because it simply went back of its own accord.

How was I to study the side-bending/rotation position? I could not do it with that helmet. So I looked for some other tools. I wandered around and found an old-fashioned wooden butter bowl that some farmer's wife had used to mix the butter after churning. I cut that down to the same size as the helmet, but I left the convex portion of the bowl on one side and made the other concave.

Then, with a flexible curved ruler such as draftsmen use, I made an upward convexity like the clivus in the cranial base. When I undertook to bend it to one side it would not do that without rotation. Therefore I had the picture of side-bending/rotation in the cranial base to guide me. Because of the rotation, the side of the convexity is lower than the side of the concavity. I named this position for the side of the convexity. I was ready to use the butter bowl.

I fastened the butter bowl to the skull this time with the bandage and brought the bandage around to the side of the concavity. By fastening the bandage I formed a concavity on one side and a convexity on the other. I felt the side-bending/rotation of the sphenobasilar junction to the right and to the left. I felt it. I knew it. I had to have the knowledge.

Then I wanted to see a twist. I went back to the helmet and arranged the bandages so that there would be a pull up on one side in front and up on the other side in back. I wound them up and clamped them with a hemostat. When I tested the arrangement, the greater wing of the sphenoid moved up on the right as the basilar process of the occiput moved up on the left. So, I had the pattern of torsion with the greater wing high on the right. That is how I learned to move the base from the vault.

Some time ago, Dr. Howard Lippincott and I were permitted to use an old skeleton that had been in a trunk at the college for a long time. We cut a couple of windows in the vault so that we could see the movement of the reciprocal tension membrane. I put my fingers on the greater wings of the sphenoid and turned them into the flexion position. Dr. Lippincott put his fingers on the temporal bones so as to throw them into external rotation. We saw that membrane — the reciprocal tension membrane of the cranium in that old dried-up specimen — move. In the animate specimen all you have to do is contact the sphenoid wings and turn the sphenoid forward, into flexion, and it will move. Turn it back and it will move unless there is something actually preventing movement. You know when it is moving properly, do you not?

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TWO

Primary Respiratory Mechanism

I WOULD LIKE YOU to consider the primary respiratory mechanism. To analyze what I mean by the *primary respiratory mechanism* let us examine its features. The first feature is the fluctuation of the cerebrospinal fluid — the potency of the Tide. The next feature, the second principle, is the function of the reciprocal tension membrane. The third principle is the motility of the neural tube — that is, the inherent motility of the brain and spinal cord. Finally, the fourth principle is the articular mobility of the cranial bones and the involuntary mobility of the sacrum between the ilia. This involuntary mobility of the sacrum is not to be confused with the postural mobility of the ilia upon the sacrum.

THE FLUCTUATION OF THE CEREBROSPINAL FLUID

The definition of the word *fluctuation* in my concept is that which is in *Webster's* dictionary, "the movement of a fluid contained within a natural or artificial cavity and observed by palpation or percussion." The fluctuation that is the first feature in the primary respiratory mechanism is the movement of the cerebrospinal fluid within its natural cavity. I call attention to the statement in *The Philosophy and Mechanical Principles of Osteopathy* by Dr. Still that says:

> A thought strikes him that the cerebro-spinal fluid is one of the highest known elements that are contained in the body, and

> unless the brain furnishes this fluid in abundance, a disabled condition of the body will remain.[1]

Within that cerebrospinal fluid there is an invisible element that I refer to as the "Breath of Life." I want you to visualize this Breath of Life as a fluid *within* this fluid, something that does not mix, something that has potency as the thing that makes it move. Is it really necessary to know what makes the fluid move? Visualize a potency, an intelligent potency, that is more intelligent than your own human mentality.

You know from your experience as the patient that the Tide fluctuates; it ebbs and flows, comes in and goes out, like the tide of the ocean. You will have observed its potency and also its Intelligence, spelled with a capital *I*. It is something that you can depend upon to do the work for you. In other words, don't try to drive the mechanism through any external force. Rely upon the Tide.

You, as an intelligent technician, or engineer, of the human body, can detect the tone, the rhythmic tone, in the reciprocal tension membrane that is operated through the fluctuation of the Tide through your thinking, feeling, seeing, knowing touch. You can also use the Tide to detect the accent when reading the rhythm of the balance in this membrane, so necessary in the reduction of strain. In working with the Tide all you have to do is give it a little "kick-off" to establish motion in a given direction.

If you were out on the ocean in a little barque and the waves were rolling high upon the shore, you would bring in the tension on the fulcrum in accordance with the balance point. In a spiritual intelligence, a spiritual fulcrum, you would be carried by the Tide in your little barque. You can depend on the Intelligence of the Tide and the potency of this fluid, the fluctuation of this fluid.

1 Still, *Philosophy and Mechanical Principles of Osteopathy*, p. 44.

Now, in your imagination, take the frame of a house to represent the walls of the brain and then suspend that house in mid-ocean. Notice that, like the house, the walls of the brain have rooms within. Then notice that there are open doorways as well as a little extension that might be called the walls of a garage connected with the house that can represent the spinal canal. The rooms represent the ventricles within the walls of the brain: the two lateral ventricles, the third ventricle, and the fourth ventricle. There are passageways: the cerebral aqueduct and the central canal of the spinal cord. There are also open doorways out from the fourth ventricle, open doorways in the wall of the brain.

Where is the brain? It is encased in what? An osseous tissue. Here there is motion of a fluid contained within a natural cavity. The cavity is within the cranial articular mechanism and also within the chambers of the brain, with open doorways. The fluid has the same constancy within the ventricles as it does without. There is the same body of fluid all around the brain as within the chambers of the brain. The cerebrospinal fluid surrounds the neural tube, the brain, and spinal cord, within and without.

Now, notice the fluctuation of the Tide — a movement coming in during inhalation and ebbing out during exhalation. Is it the waves that come rolling along the shore — is that the tide? No. The movement of the tide is the movement of that body of water, the ocean, that constant body of water. See that potency in the tide; more power, more potency in that tide than there is in the waves that come dashing upon the shore.

See the water going out from that wide river down at Fort Myers, Florida during a hurricane, it went way out and left the river bed dry. Then, it came back — not the waves but the tide. And this potency? That is what I want you to see: the potency in the fluctuation of the cerebrospinal fluid. Most of all, the

Breath of Life that was breathed into this form of clay and man became a living soul.[2]

If you were to take a glass of water, place it on a table, and shake the table, the water would spill therefrom. However, if I took my hand and gave a transmitted vibration from my shoulder to the table, you would see that water come up to the center of the glass in a little quiver. That is what I want you to see in the potency of the Tide in the cerebrospinal fluid. Not this up and down fluctuation during inhalation and exhalation, but the condition where you get the movement down to a balance point between inhalation and exhalation, a midway point. This midway point is where you have a brief period where you observe that the diaphragm is moving gently at a fulcrum point. Then you get this vibration to the center of the Tide, the point where you might say that you have come to what was known in a hymn as "The Still Small Voice." You have heard the hymn, "Be Still and Know that I Am."[3] Do you get the point? It is the stillness of the Tide, not the stormy waves that bounce upon the shore, that has the potency, the power. As a mechanic of the human body you can bring the fluctuation down to that short rhythmic period, that stillness, if you understand the mechanical principle of this fluctuation of the Tide.

Then you begin to understand something about the groundswell of the ocean and differentiation of the tide, of the waves and so forth. There is a sort of spiral movement. You have heard of the different movements of the brain. Let us explore another — a spiral movement of the Tide. Make a diagram with a pencil on a piece of paper. Make a dot at a given point. Starting with the dot, draw a line around in a curve and then around and

2 "And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life, and man became a living soul." Genesis 2:7, King James Version.

3 "And after the earthquake a fire; but the Lord was not in the fire: and after the fire a still small voice." 1 Kings 19:12, "Be still, and know that I am God." Psalms 46:10, King James Version.

around. Then, make a dotted line around the other way back to the original dot. Let these illustrate a spiral movement.

If you want to use this diagram to represent a material manifestation, designate a positive pole and a negative pole. Then we get something in between the positive and the negative poles to see in that slow movement of the Tide, that coil, a moving out and a coming together. How many spiral movements can you visualize in the Tide? How many little coils?

Go with me along a shore where there is a lot of seaweed growing. Watch this seaweed moving rhythmically in a coiling form, one going clockwise, another counterclockwise, spiralling with the groundswell. Look at the hurricane. See the potency in the eye of the hurricane, not the destruction around the outside. See the potency of the eye, the stillness of the Tide, the spiral movement.

THE RECIPROCAL TENSION MEMBRANE

My next assignment is in two parts. The first is the *reciprocal tension membrane*, with emphasis upon the tension. The second is the fulcrum. The function of these is the second principle in the primary respiratory mechanism. Because there are no muscular agencies to account for mobility between the cranial bones at the sutures, it is necessary to account for it in some other way. The structure that does connect the bones is the intracranial dural membrane and the intraspinal dural membrane.

The late Ray G. Hulburt, D.O.,[4] editor of the *Journal of the American Osteopathic Association*, was kind enough to read the early chapters of *The Cranial Bowl* before they appeared in print. He made valuable suggestions, and after some discussion he came to see how simple the terminology is in describing the function. We took the example of a tug of war with a team at each end of the rope. The rope would be the reciprocal tension

4 (1884-1947) American School of Osteopathy, 1920.

membrane. They would pull it this way, they would pull it that way, the rope would be under constant tension. Then, perhaps, they would get a balance point, a still point, that would serve like the fulcrum in a pair of scales. Not a lever. A lever operates over a fulcrum, back and forth.

The fulcrum in the action of the reciprocal tension membrane in the membranous articular mechanism of the living human cranium is a still point around which or over which the constantly tense membrane operates the poles of articular attachment.

You will note that I arranged a schematic way for describing the attachments of the reciprocal tension membrane — the attachments of the falx cerebri and the tentorium cerebelli. I named a posterior pole (the occiput), two lateral poles (the petrous ridges), an anterior superior pole (the crista galli), and an anterior inferior pole (the clinoid processes). (See Figure 4.) Note another articular pole at the sacrum, operated through the mechanism. I have emphasized the tension, the pull, in the reciprocal tension membrane between the poles of articular attachment in the cranial mechanism. These schematic names are simply to show that all the bones of the neurocranium are attached to the mechanism that moves them. You can feel the action when reducing cranial membranous articular strains. It is the same mechanical principle that functions when you are reducing a ligamentous articular strain in the vertebral column. You can feel the action of the ligaments that hold an intervertebral joint together and allow its range of motion.

THE MOTILITY OF THE NEURAL TUBE

The third principle in the primary respiratory mechanism concerns the brain and spinal cord — the central nervous system. This system forms as a tube in early embryonic life and remains a tube throughout. That statement in itself shows that it is simple. It is not so difficult to understand the brain if you look at it as a mere neural tube. When the cerebral hemispheres get up on top of the head they are just bottom side up. That is all. However, there is something else — motility. Physiologic activity manifests movements of the cells and of the brain that have mechanical features, motility. This motility has a mechanical function in the operation of the primary respiratory mechanism. Therefore, the neural tube has mechanical action as well as the neurophysiology that is the function of carrying messages. The mobility of the bones of the skull is accommodative to that motility within the brain and spinal cord and to the fluctuation of the cerebrospinal fluid.

Every detailed feature in the articular surfaces of the cranial bones is an indication that points to articular mobility. There are no articular surfaces in the development of these bones before the third, fourth, and fifth years of life. At birth the one established joint in the head is the occipitoatlantal. It seems that the Master Mechanic provided for a molding of the osseous mechanism so that a safe passage through the birth canal could be achieved in a normal delivery.

Later on, the motility of this neural tube begins to form osseous articular gears in the mechanism. This motility of the brain and spinal cord is the third principle in our analysis of the primary respiratory mechanism. Motility. What happens in the spine? The spinal cord moves upward, like a tadpole's tail, during inhalation and drops downward during exhalation. At the same time the brain does something that affords what? Dilation and contraction of the ventricles which contain this body of cerebrospinal fluid. Not only that, there are tracts which have motility as well as the function of carrying nerve impulses. Otherwise the fluid would be restricted in the pathway from the fourth to the third or from the third to the fourth ventricles. These walls allow a widening and a narrowing of the cerebral aqueduct.

Now consider the interior of the brain. See this cast of the ventricles. I see the third and fourth ventricles forming the body of a bird. The central canal of the spinal cord can be the tail of the bird. The two lateral ventricles look like the wings of a bird. Where are they attached? Up where any wings are attached on a bird: off the anterior superior angle of the body. The third ventricle, as the front part of the body, is a chamber for fluid. Now, during inhalation, I want you to see those ventricles moving the same as a bird does when it goes into flight. As the wings spread they glide up a little more posteriorly than they do in front. What does the bird wing do when the bird lights on a twig? It folds down in exhalation.

"A Tour of the Minnow"

Editor's Note: From time to time Dr. Sutherland was prevailed upon to give an extemporaneous talk about the brain which he called a "Tour of the Minnow." Another one is presented in Chapter 17. No two were alike.

The little minnow in my imagination sees the formation called the cerebellum. He looks at the two hemispheres and considers the construction of that mechanism. It seems to be working something like the blacksmith's bellows. That is, the convolutions of the cerebellar hemispheres look like bellows. Then there are the tracts, nerve tracts, running from the cerebellum around in front of the medulla oblongata and the bridge that is called the pons.

He begins to think about additional functions, physiologic functions other than carrying the nerve impulses. These are indicated by the living, active body, by the motility of the walls. He comes to the top of a chasm through this little aqueduct that leads to the top. He sees narrow walls and the next thing he knows those walls move so as to make a V-shape of the chasm. They move again so as to close it. The V-shape occurs with inhalation and the narrowing with exhalation. He wants to see the bottom so he dives down through the fluid and meets the hypothalamus. Let us leave him there. No. Let us have him do something else.

We will have him go up to the reciprocal tension membrane, to the falx cerebri, and ring the ethmoid bell. He can use it by way of the crista galli to move the ethmoid like the bell on a locomotive. With the rocking motion we can see what happens to the olfactory bulbs as they rest on the cribriform plates with the olfactory nerves hanging down. You know of the cerebrospinal fluid in those bulbs, along those tracts that are said to belong to the brain. That is a different formation than the usual arrangement for the cranial nerves. You can read about the experiments that Speransky did in this region.[5] I call your attention to this system that protects the nasal mucosa.

Let us go back to the third ventricle, that narrow chasm that widens with inhalation. I want you to see the real stretch of the roof during inhalation. See that choroid plexus upon the roof, not in the ventricle. I want you to see that choroid plexus alternately stretching out and bunching up during inhalation and exhalation. There is your mechanical principle for interchange between the blood and the cerebrospinal fluid. Realize the motility of the brain and the motility of the choroid plexus, which is pia mater and a part of the blood vascular system, not the nervous system. Go out into the walls of the lateral ventricles and find the same arrangement, a curtain between the choroid plexus and the ventricle. Go back to the fourth ventricle and see the same mechanical picture.

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5 Speransky was a Russian scientist who described experiments using ink tracers that confirmed the existence of a direct connection between the lymphatic system of the neck and the corresponding network of the nasal cavity. He had already said that outflow from the cranial base takes place through the perineural spaces around the "fila olfactoria." He found that the ink passed from the cerebrospinal fluid into the nasal cavity and was then immediately found in the lymphatic glands of the neck. A. D. Speransky, *A Basis for the Theory of Medicine*, ed. and trans. C. P. Dutt (New York: International Publishers, 1943), p. 111.

* * *

I have been giving you a description of the material mechanism, that mechanism man utilizes in his walk about on earth. I call your attention to the location of the physiologic centers in the floor of the fourth ventricle that regulate the secondary mechanisms of the living body. The location of these vital primary centers points out my reason for naming the primary respiratory mechanism *primary*. That great battery, the Tide, functions through that region. Realize that the "highest known element" is transmuted to these physiologic centers. The cranial nerve nuclei also receive the transmutation from that "highest known element," from the battery that contains the "juice."

THE ARTICULAR MOBILITY OF THE CRANIAL BONES AND THE INVOLUNTARY MOBILITY OF THE SACRUM

The fourth principle in the analysis of the primary respiratory mechanism is the articular mobility of the bones of the cranium at the sutures and the involuntary mobility of the sacrum between the ilia (the pelvic bones). Note that here I am not speaking of the postural mobility of the ilia upon the sacrum. There is a movement that operates through the reciprocal tension membrane. See how the dural membrane connects up all the parts, including the sacrum, as an interosseous membrane.

After the "gears" in the articular surfaces of the cranial bones begin to form, the mobility of the whole is present. You might say that the brain does not require a muscular agency for mobilizing this mechanism. You can prove that to the satisfaction of any skeptic. When they make a criticism of your cranial mechanism, as they did of mine, and ask, "Where are the muscular agencies to propel this articular mobility?" all you have to do is to point down to the sacrum.

Dr. Still proved articular mobility at the sacroiliac joints, even at a time when the textbooks called them synarthroses.

Ask your critics if they can find any muscular tissue running from the sacrum to the ilia. Let them search for it. There are no muscular agencies for articular mobility between the ilia and the sacrum.

What they will find is that the sacrum is suspended beneath the ilia by ligaments. The articular surfaces are L-shaped. In two papers in the *Journal of the American Osteopathic Association*, Walford A. Schwab, D.O., a professor at the Chicago College of Osteopathy, called attention to the shape of these articular surfaces. He noted not only the L-shape but also the little niche in one surface and the little ridge in the other, all for a purpose in its function.[6]

Consider the description of the osseous cranial bowl in standard texts. You meet a statement pointing out that the bones of the base of the skull are formed in cartilage and the bones of the cranial vault are formed in membrane. When you look down upon the bones that are formed in cartilage, your bump of reasoning says, "articular mobility in the cranial bowl." Then, you put a cap on the bowl. That cap (the vault), that membranous cap, would interfere with the articular mobility of the bones of the base of the skull unless it provided some compensation through the sutures. The peculiar dovetailed interlacing between the parietal bones in the sagittal suture, for example, show features that can accommodate the mobility between the bones of the base, which form in a cartilaginous matrix. In the adult, the bones of the cranial vault have two walls with diploe between them. They are flexible as well as accommodative at the sutures.

This living human body is a mechanism. It includes the osseous articulations, the flow of blood in the arteries and veins, the intricate mechanism of the lymphatic system, and that great

6 The papers first appeared in 1928 and 1932 and were then reprinted: Walford A. Schwab, "Anatomical Mechanics, *Year Book*, Academy of Applied Osteopathy, 1952, pp.141-142.

hydraulic system, the cerebrospinal fluid. You must continually hold before you the intracranial pictures for diagnosis and treatment. Through the science of osteopathy as envisaged by Dr. Still, the cranial concept provides a picture that must be carried in the mind of the operator in order to diagnose and treat the correct problem.

Then I look further and find a venous channel that is different from the usual. A picture of the membranous tissues that form the venous channels suggests that restriction here could lead to pathology in the brain. I think this way: Unless there is some mobility in the skull mechanism that will move that venous blood along, there will be a stasis in the circulation. There has to be some compensation for movement in the cranial base, so I began to look at the mechanism in the vault. I found that the dural membrane has two walls, an inner and an outer, and the venous sinuses are formed between them. There is provision for articular mobility in the sutures of the vault and that same compensatory movement moves the venous blood along.

When I came to study the posterior inferior angle of the parietal bones, the mastoid angle, I found that the lateral sinuses pass right over the inside of that angle before they become the sigmoid sinuses which carry venous blood to the jugular foramina. Then I noted the corrugations in the parietomastoid articulations that show the direction of the movement of the parietal bones, in and out. I could see that movement of the mastoid angles of the parietal bones, in conjunction with the movement of the temporal bones, moving the walls of the lateral sinuses — those membranous sinuses.

What moves the blood along the petrosal sinuses, also located in membrane? I reasoned that the petrous portion of the temporal bones rotates inward and outward, a roly-poly movement. Then there is the cavernous sinus, also having membranous walls. What moves the blood along there? I began to reason that the sphenoid bone circumrotates forward and backward, and those walls are moved as it does so.[7] You can see the sort of mechanism that carries venous blood along as the reciprocal tension membrane, which is attached to the bones, is shifting in its regulation of the movement of one bone and another.

* * *

The next subject for this study is the occiput. The first thing to consider is the circumference of the occiput, which includes appendages such as the basilar process, the condyles, and the squama that displays a bend. The occiput forms most of the back of the head and a large part of the cranial base. The foramen magnum is located on the bottom in human beings. Look at the bone as a wheel. Consider particular locations as spokes of the wheel or points on the circumference. As the occiput circumrotates during inhalation, it moves forward and up a little so that the sphenobasilar junction in the clivus is carried forward and up. The foramen magnum does not remain at the lower level. (See Figure 1.)

I am emphasizing the foramen magnum especially because the dura mater is firmly attached to its rim. This is the upper attachment of the intraspinal dura mater, which is a continuation of the inner layer of the cranial dura mater. The intraspinal dura mater is not attached to the atlas. It is attached to the axis and sometimes to the third cervical vertebra. From this upper area it hangs somewhat loosely, like a hollow tube, until it reaches the sacrum where it has another firm attachment to bone. As the occiput moves forward in inhalation you can see that the foramen magnum moves upward to a higher level. You see the intraspinal dural membrane rising and taking the sacrum along with it. Do you get the point? There is a movement of

7 *Circumrotate* is defined in *Webster's* dictionary as "to turn like a wheel." The movement of the sphenoid and the occiput is a rotation about a transverse axis. Dr. Sutherland used the term circumduction.

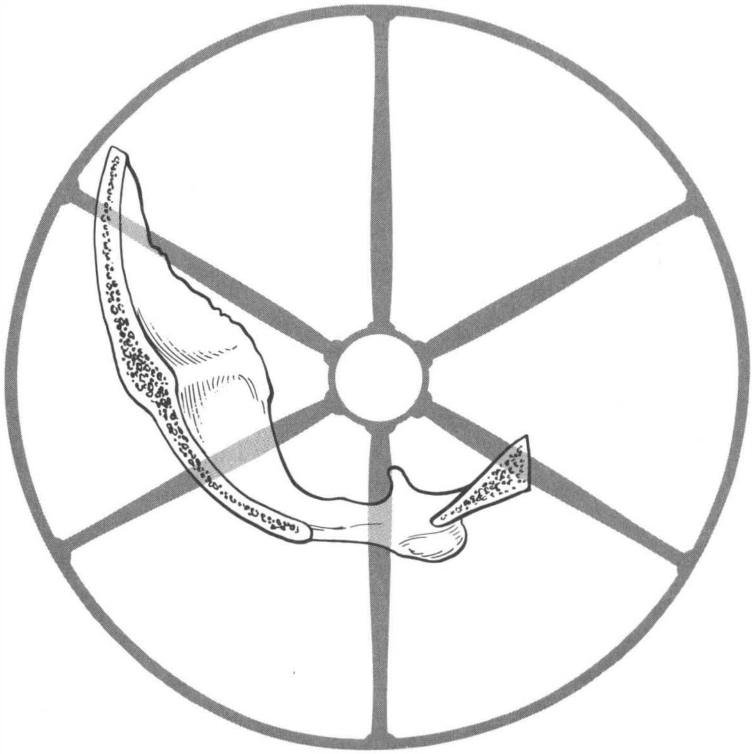

Figure 1. The occipital bone pictured as a wheel, showing how various locations change their position as the occiput circumrotates on its axis.

the reciprocal tension membrane of the spinal canal that lifts the sacrum into a position with the base upward and the apex forward (flexion).

Editor's Note: Recent anatomic studies have demonstrated that the dura mater is attached to the vertebral canal in the lumbar region. The anterior attachments are short and strong while the posterior attachments are weaker and longer. The anterior and anterolateral connective tissue bands attach to the posterior longitudinal ligament. The bands are strongest at the L5-S1 level and less strong in the upper lumbar region. The dural nerve root sheaths are also attached to the posterior longitudinal ligament anteriorly and to the periosteum of the inferior pedicle laterally.[8]

Consider the greater wings of the sphenoid as spokes of another wheel. See the little ethmoid spine as yet another spoke, together with the pterygoid processes and the sella turcica on the sphenoid wheel. These bones, the occiput and the sphenoid, circumrotate. The spokes of the wheels move to different levels as the wheels turn to and fro. This mental picture may help you in your understanding of the mechanism.

The next topic is the temporal bone. I often describe this bone as the "wobbling wheel." You can probably picture a wobbling wheel from your memory. The temporal bone moves in that fashion. Consider the petrous portion of the temporal bone as an axle. In this concept I refer to the petrous portion when I speak of the internal or external rotation of the temporal bone. I do this because the petrous portions of the temporal bones are down in the cranial base articulating with the basilar process of the occiput in a tongue-and-groove type of articulation. The basilar process of the occiput is inaccessible to the operator, just like the bodies of the vertebrae. You cannot touch them. You cannot see them. Therefore, you must visualize the situation just as you visualize the body of a vertebra and the heads of two ribs.

I speak of the petrous portions as being in either external or internal rotation. The physiologic movement during inhalation, when the occiput moves into its flexion position, turns the petrous portions into external rotation in relation to the basilar

8 I. G. Parkin and G. R. Harrison, "The Topographical Anatomy of the Lumbar Epidural Space," *Journal of Anatomy* 141 (1985): 211-217, and David L. Spencer, George S. Irwin and J. A. A. Miller, "Anatomy and Significance of Fixation of the Lumbosacral Nerve Roots in Sciatica," *Spine* 8, no. 6 (1983): 672-679.

process. That is why I call the petrous portion the axle upon which the temporal bone moves. Do not forget that the petrous portions converge anteriorly and diverge posteriorly, thus following the physiologic functional design in all of the articulations of the spine as well as the cranium.

This axle, the petrous portion of the temporal bone, turns upon the jugular process of the occiput as on a pivot. The squamous portion of the temporal bone is set off so that when the petrous portion rotates externally, it moves outward while the mastoid process moves inward. Visualize the wheel, the disc of the wheel, wobbling. In the other direction, in internal rotation, the squamous portion moves inward and the mastoid process moves outward. That is the picture of the wobbling wheel in the internal and external rotation of the petrous portion as the axle of the temporal bone.

I call the temporal bone the "mischief maker" or the "clown" in the cranial articular mechanism. This comment points to the fact that I have found more trouble originating from problems with that little temporal bone than from any other in the cranium.

As you *think osteopathy* with Dr. Still, think of the origins and insertions of soft tissues, muscles, and fascias, not only bony tissues. Consider drags on the fascia and crowding of muscular tissue in certain positions of the petrous portions. Remember that whenever the basilar process of the occiput is tipped up on its side, the petrous portion on that side is always carried into internal rotation. It then follows that the petrous portion on the other side, the low side, is always carried into external rotation. If the basilar process is in an extreme flexion position at the sphenobasilar junction, both temporal bones will be in marked external rotation.

Editor's Note: This law applies to the fact that the occiput carries the temporal bones on the jugular processes. Therefore, if the occiput is turned on its anteroposterior axis, the temporal bones are automatically carried into a position as stated. In this case there is no motion between the two bones, the temporal and the occiput, to consider.

Visualize the bunching up, the crowding, under these conditions of all the soft tissues between the sphenoid, the basilar process of the occiput, and the petrous portions of the temporal bones on the outside of the cranial base, underneath these bones. There is no end to the depth of this picture, either on the inside or the outside.

Look at the pterygoid processes of the sphenoid, the greater wings and the lesser wings. See the different levels of the spokes of the wheel, including the ethmoid spine, as the sphenoid

Figure 2. The sphenoid bone pictured as a wheel, showing how the landmarks and processes change their position as the sphenoid circumrotates on its axis.

wheel turns to and fro. Note that the promontory of the sphenoid does not move at its level. It does not move forward or backward. It is a suspended wheel, circumrotating so that the little spokes, or projections, are moved from place to place. Follow them around. It will help you to visualize the point of lesion in your technique.

You can study the cranial mechanism all the way through in this way. You will find problems and the answers to problems. Prove to any who may be skeptical, perhaps more skeptical than I was in the beginning, that the living human head has articular mobility, as well as protective stability. When they try to prove that the bones of the human adult cranium cannot move, they will get a shock, as I did, the more they study it. They will find indications for mobility in every articular surface in that mechanism.

THREE

The Fluctuation of the Cerebrospinal Fluid

We have now come to a further study of the cerebrospinal fluid in the cranium and in relation to the whole body. There are several mental pictures we can use. For me, the Breath of Life, not the breath of air, is the main one. The breath of air is merely one of the material elements that the soul of living man utilizes in his walk about on earth.

The first principle in the primary respiratory mechanism, the fluctuation of the cerebrospinal fluid, has a potency with an Intelligence, as I found out. This potency is an invisible "fluid" within the cerebrospinal fluid. The potency of the Tide is what we have to consider — something with more power in the reduction of membranous articular strains of the cranium than any force you can safely apply from the outside. It will function intelligently. Carry this in your mind and along with it carry the mental picture that comes in answer to the question, "How do these membranous tissues restrict the fluctuation of the Tide?"

What are bones but fluid, a different form of fluid? What is that little hailstone that comes down from heaven but fluid? What is this earth out here, this world that we walk on, but fluid? It is all material manifestation and, back of that, fluid, when we learn to think with Dr. Andrew Taylor Still. He lived closer to his Maker than mere material breathing. Do you get the thought?

The tide. You watch the tide of the ocean, and you watch that ferry boat going across San Francisco Bay from Oakland. As the ferry gets near Treasure Island it bumps up against something. Time or tide? You will find that the pilot controls the wheel so that the boat is on a balance point and is turned right around by the potency of the incoming tide. Then, on the next trip, why does the pilot steer another course a little further out from Treasure Island? It is a different time of the tide. Or, maybe, there is a meeting with a groundswell, with an undulating, up and down. There are so many things to study in the tide of the ocean.

Compare it with this fluid in the living body, this Tide in the body with its potency. That is what we have in this first principle. The Intelligence in the power in the Tide. We refer to the potent fluctuation of this Tide and to something that is intelligent, something invisible. We are referring to the Breath of Life in that Tide.

You can visualize an X-ray that jumps from a positive to a negative pole. You see the equipment, but you cannot see the ray that exposes the film and makes the picture, the shadow picture. There is a potency in something invisible. This is like the fundamental principle in the primary respiratory mechanism, that "highest known element" to which Dr. Still called your attention. He didn't mean this material fluid that you can see, but that element in the Tide, in that fluid.

I call your attention to the water, the clear water, in the battery of your car. You have chemicals in that water, material chemicals. But you cannot see the invisible element, the electrical "juice" that comes from that water, that passes along the wire that runs to the motor of your car. That is the potency, the power, that comes from the battery. From time to time you have to replace the water in the battery.

There are interesting questions and remarks in the little text entitled *Dr. Still in the Living* by Robert E. Truhlar, D.O.[1] One

1 Privately published in Cleveland, Ohio, in 1953.

says this: "The Grand Architect of the Universe builds without the sound of hammers, Nature is silent in her work." Another: "Electricity is a form that is naturally required to contract muscles and force gases from the body." Do you see the Tide as a battery with waters within which are chemicals? What do you have in that combination? The "juice," that invisible potency, the battery of the human body.

For another mental picture to think with, consider all the fibers in a nerve trunk. Did you ever see a cable, or an illustration of a cable like the transatlantic cable, and learn how it functions? Lots of little copper tubes enclose a potential wire. Between that potential wire and the copper tube there is information, little bits of information. You can push a button here or there along the copper tube, as on a radio, to get whatever program you want. All the programs come over that copper tube. The "finer nerves dwelling with the lymphatics" could be similar to these kinds of operations and not to the usual way messages are carried by nerve fibers.[2] In this picture there is also a transmutation from the cerebrospinal fluid, that "highest known element" formed in the "copper tube." Then there are the "push-buttons," if you want to call them that, that connect to this station and that station in the tube. It is a beautiful process.

Visualize that "something" in the cerebrospinal fluid that has a transmutation in the nerve cells or tracts, or in a "copper tube." It doesn't flow along the nerve fibers as though they were wires. It is a change in form, if you wish. It doesn't run something. That something is in the tubes. Something like a unit from one radio station to another.

What does Dr. Still mean when he speaks of "finer nerves dwelling with the lymphatics than even with the eye?" Do you find lymphatics in the nerves? No. He is pointing to something

2 "Possibly less is known of the lymphatics than any other division of the life-sustaining machinery of man. . . . Finer nerves dwell with the lymphatics than even with the eye." Still, *Philosophy and Mechanical Principles of Osteopathy*, p. 66.

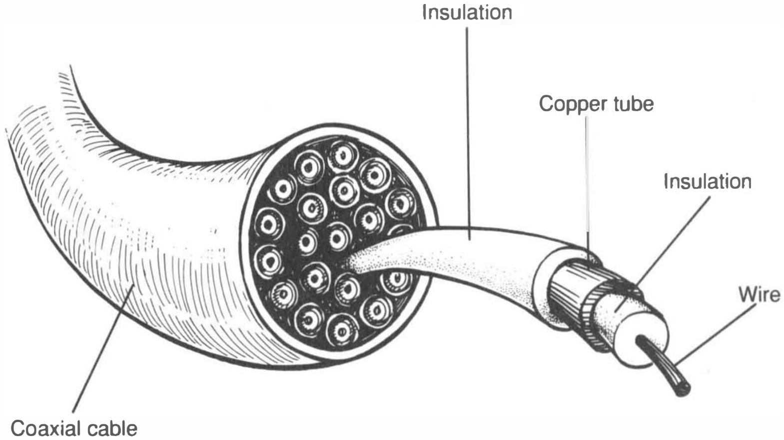

Figure 3. A coaxial cable is a device for the simultaneous transmission and strengthening of multiple radio, television, or telephone signals. The cable may house twenty or more coaxials, each consisting of an outer tubular conductor surrounding a central conductor held in place by electrically insulating material. The tube shields the signal from outside electrical interference and prevents the signal from losing its strength.

else. He wants us to see this "copper tube" and the wire within, the potential. The principle is used in the material cable that carries messages across the Atlantic Ocean. Messages, many different messages, are running over that copper tube.

Do you know anything about sheet lightning? You see its manifestation all through the cloud, but it doesn't touch the cloud. I want you to see this invisible "liquid light," or the Breath of Life as sheet lightning and a transmutation; the sheet lightning all through the nerves, not touching the "copper tube." The transmutation is what Dr. Still pointed to in the early days as "nerve force." He was trying to put across this understanding using the example of the electrical force, or the electrical "juice," that runs along the wire. That signal that runs along has to have a tract to run on.

It is a push-button mechanism, an attunement within the human body. Tuned to what? To that "highest known element," the Breath of Life, not the breath of air. Quoting another text: in the creation of man, the Breath of Life was breathed into the nasals of a form of clay, and man became a living soul.[3]

Editor's Note: Dr. Sutherland is pointing to possibilities; he is presenting the idea that more than the simple transmission of electrical impulses is occurring within the nervous system.

I am beginning to see what he means by a finer element dwelling with the lymphatics. Consider the lymphatic vessels and their nodes carrying tissue fluid and lymph back to the venous system before venous blood enters the heart. When infection is present and lymph nodes enlarge, they are swelling up because they are holding something. They hold firm until a message comes along and electrolysis takes place that affects the lymph node so that the lymph is changed before it is moved into the bloodstream. You can understand how the lymphatic system works, and even more, how the viscera work.

You will be able to disseminate the contents of enlarged lymphatic tissue without the development of spontaneous eruptions or abscess formation. It will disappear as it has in instances when the fluctuations of the cerebrospinal fluid has been under the control of a cranial technician. This is not an idle statement. The possibilities you have in the science of osteopathy apply to the quotation, "Finer nerves dwell with the lymphatics than even with the eye." Can you believe that?

Look into the infundibulum that connects the hypothalamus with the pituitary body in the sella turcica. Think of the infundibulum as a copper tube with a potential within, a current, and an insulation around it — that is, between it and the copper tube. Then, think of a transformation from the potential and the power in the battery that runs out in the copper tube.

3 Adapted from Genesis 2:7. For the full quotation, see the footnote on p. 16.

When you send messages over that tube you have push-buttons that function like the many radio stations that can be tuned in. Only one "copper tube" with many wires within. Perhaps this will help you understand the infundibulum.

* * *

Let me tell you about an experience that I had with the Breath of Life.[4] It happened on the shore of Lake Erie where the depth of the water, out for half a mile or more, is hardly above the knees. A man and his companion went out on the shore to go bathing. They had been imbibing some bad liquor — what was available in those days of Prohibition.

This man became ill; he collapsed in a state of meningeal shock and his companion carried him to shore. He had not drowned for there was no water in his lungs. People there worked on him with the proper methods of resuscitation without success. I heard the commotion and went down there.

I found a specimen, a cadaver, as stiff as a rod and as blue as a whetstone. There was no sign of respiration. I grabbed the temporal bones and rotated the petrous portions into external rotation as I turned the occiput into flexion. (You will learn later to understand these positions.) What did that do?

The tentorium cerebelli is attached to the superior borders of the petrous portions of the temporal bones and to the inside of the occipital squama. The anterior reaches of the tentorium cerebelli are attached to the clinoid processes of the sella turcica of the sphenoid bone. As I turned the bones with my hands the tentorium was moved.

Beneath the tentorium cerebelli is a body of cerebrospinal fluid that surrounds the brain stem and cerebellum, as well as

4 This story is also told in a footnote in *The Cranial Bowl*. Dr. Sutherland describes it as a case that ". . . appeared like that of shell-shock to the meningeal area . . ." Sutherland, *The Cranial Bowl*, p. 54.

being within the brain stem. Within this body of fluid is that "highest known element" to which Dr. Still pointed; and within the brain stem, within the medulla oblongata, are the primary centers controlling the physiology of the body, especially the center for respiration.

After I had turned those bones, a sensation of warmth occurred in my hands. Respiration began. I released the mechanism and it ceased. Someone kindly said, "Why don't you send for a doctor?" I tried the experiment again and the same sensation of warmth came back. His head gave a sudden jerk and he spoke to his sister.

The man's physical mechanism had been dead, stalled. It was locked in meningeal shock; the arachnoid membrane was locked down upon the brain. Fortunately, however, the Breath of Life was in this body of fluid. All I did was "crank the car." I have known of two other cranial technicians who have been able to perform a similar experiment under critical conditions.

You will understand, when you consider such critical conditions, why I have said from time to time, "When you do not know what else to do, compress the fourth ventricle." Keep in mind the Tide with its Intelligent potency, spelled with a capital *I*. It is something you can depend upon. Something that knows how. When you are somewhat doubtful of the diagnosis in some conditions, consider the Tide and compress the fourth ventricle.

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FOUR

The Reciprocal Tension Membrane

LOOK AT THE VERTEBRAL column to see the ligaments that hold the spinal articulations together and also allow a certain range of movement at these joints. Then look inside the skull to find what does the very same thing as those spinal ligaments. There is an interosseous membrane that holds the bones of the neurocranium together and allows a certain range of normal movement at the joints.

The interosseous membrane inside the skull is called the dura mater. It is a tough, nonextensible, fibrous membrane that has an outer and an inner wall. The outer wall serves as periosteum. The inner wall has specializations that drop down in folds between parts of the brain. The fold that drops down in the sagittal plane between the cerebral hemispheres is called the falx cerebri. The fold that is spread out over the cerebellum is called the tentorium cerebelli. This whole membrane with its folds is attached to all the bones of the neurocranium. The name falx refers to the sickle shape of the falx cerebri. If you look at one side of the tentorium cerebelli you see another sickle shape. The other side looks the same. When you see it this way, you see three sickles that meet in the back part of the inside of the head.

The falx cerebri is fastened to the crista galli of the ethmoid bone, to the frontal bone, the two parietal bones, and to the interparietal occiput. It is tough, firm, and tense. I used to say

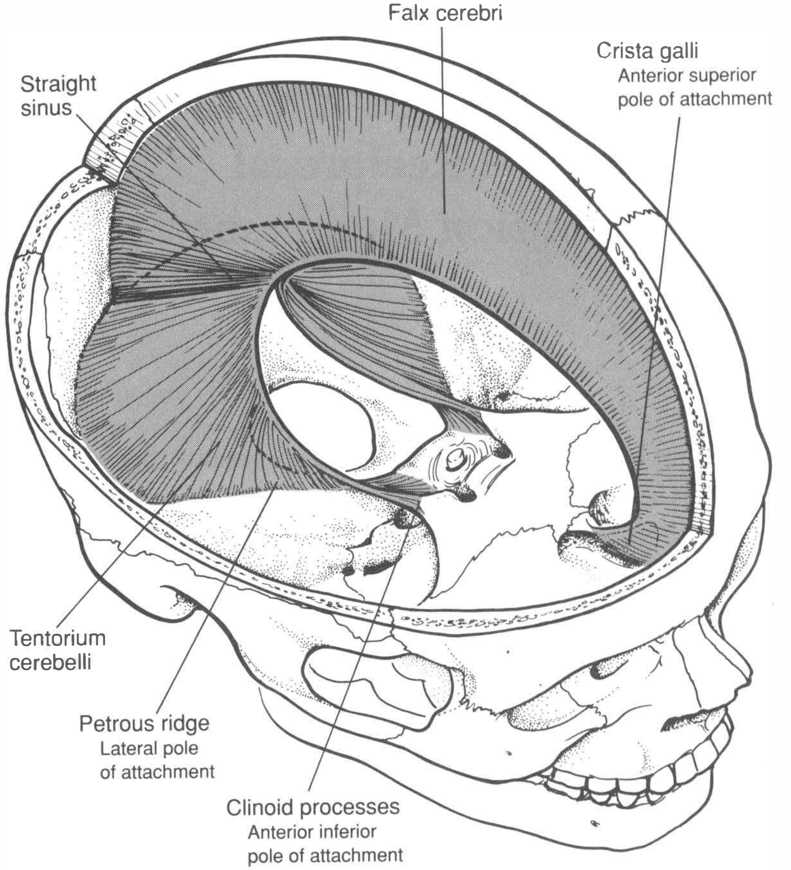

Figure 4. The cranial component of the reciprocal tension membrane, showing the schematic representation of the poles of attachment.

that if you could get in there, you could pull on the falx and ring the ethmoid bell. That is, swing it back and forth like the bell on a locomotive. That is the anterior superior pole of attachment for the falx cerebri.

When I look at the tentorium cerebelli, I am struck by the shape of two sickles. That inclines me to call it the "falx tentorium." You could say "falx cerebelli" because it rides above the cerebellum, but I prefer "tentorium" as I have used the term. The two sickles make the "tent." The "tent" is attached all along the inside of the occipital squama, in the middle. The lateral sinuses are formed by this attachment. [Dr. Sutherland regularly referred to the tentorium cerebelli as the "tent." –Ed.]

Then the "falx tentorium" passes over the inside of the posterior inferior angles of the parietal bones. These are the mastoid angles just above the parietomastoid sutures. After that, the "tent" runs along on the superior borders of the petrous portions of the temporal bones. These attached borders of the petrous portions are called, schematically, the lateral poles of attachment of the tentorium cerebelli. They go forward to fasten to the posterior clinoid processes of the sella turcica of the sphenoid bone. Because of the sickle shape, the "tent" has a free border that forms the tentorial notch. This inner border makes a turn before extending on to the anterior clinoid processes of the sella turcica of the sphenoid.

This area, where the anterior reaches of the tentorium cerebelli attach to the four clinoid processes of the sella turcica, is the area of the anterior inferior pole of attachment. The diaphragma sella covers the sella turcica where the pituitary body is located. The infundibulum from the hypothalamus passes through to the posterior part of the pituitary. This situation is one of the little things that may be a big thing in the science of osteopathy.

When we look at the two sickle-shaped halves of the "tent" together with the falx cerebri, we see three sickles that meet at the area of the straight sinus, where the falx adjoins the "tent." On the two halves of the "tent," see that the curve has been cut off, as it were, where the "tent" is attached to the superior borders of the petrous portions of the temporal bones. Both sides are the same and these lateral poles of attachment are an important part of the whole inside of the neurocranium. Note that the petrous portions converge anteriorly and diverge posteriorly. That is, they run diagonally forward.

Look at the inside of the skull and see that the falx cerebri and the "falx tentorium" (tentorium cerebelli) are attached to all the bones of the neurocranium. The falx cerebri in the sagittal plane carries the superior sagittal sinus; the tentorium cerebelli carries the lateral sinuses across the middle where the confluence of sinuses is located. At the internal occipital protuberance the straight sinus brings venous blood from the inferior sagittal sinus and the great cerebral vein of Galen to flow into the lateral sinuses. This area is the posterior pole of attachment of both the falx and the "tent" in this schematic description.

Note that the three sickles on the inside of the cranium, specializations of the inner layer of the dura mater, constitute one structure that holds all the bones together. I call this the *reciprocal tension membrane* of the human cranium. It allows a normal range of movement of the bones at the sutures. The tension in this membrane is emphasized because you could not have a reciprocal mechanism unless it were continually tense. This applies not only to normal positions but also to strains. The tension holds constantly just as the neural tube remains a tube throughout life.

Consider a model that shows the three sickles fastened together. Such a model can illustrate the schematic idea. But what does this structure inside the cranium mean to you? What does the sickle shape imply? If you have a scythe, which is nothing more than a big sickle, how do you use it? You don't use it to chop the grass down. You use it as intended, as a tool to swing around in a large circle close to the ground. You move posteriorly as the whole comes forward. When you get around to the anterior tips of the falx and the "tent," you see that they move posteriorly. That is the advantage of the sickle shape for these interior structures.

The falx cerebri draws the ethmoid backward as the crista galli goes up. The clinoid processes of the sphenoid go backward as the "falx tentorium" goes forward. This shows how the

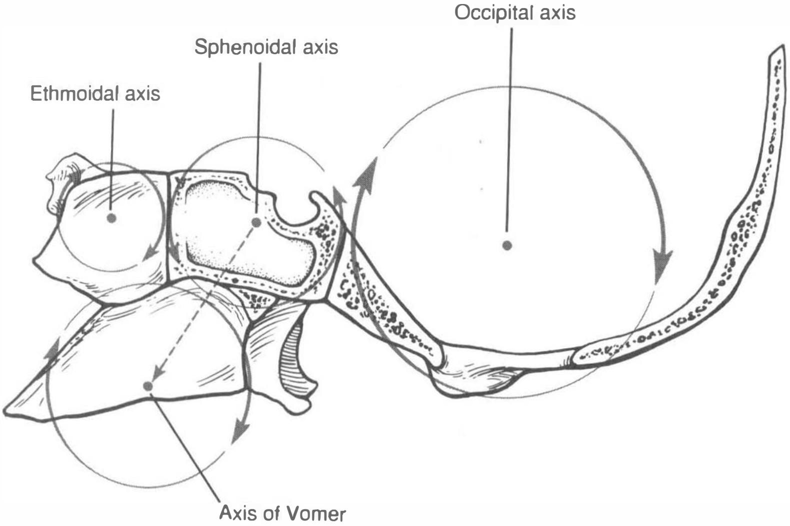

Figure 5. The cranial base in flexion, showing the rotation that takes place about parallel transverse axes. Note that the ethmoid and the occiput rotate in the same direction while the sphenoid rotates in the opposite arc, as would be the case with three intermeshed cog wheels. The dotted line represents the vector of force transmitted from the movement of the sphenoid through the vomer.

reciprocal tension membrane pulls these areas. At the lateral poles of attachment the petrous portions of the temporal bones are lifted and turned into their position of external rotation. The posterior pole of attachment at the occipital squama comes forward. The total effect on the neurocranium is the change in shape that I call flexion because the sphenobasilar junction in the clivus is increased in its upward convexity. You can see the effect on the whole in this schematic description. The distance from front to back is shortened, the distance from top to bottom is shortened, and the distance from side to side is lengthened.

When the change in shape that I call extension occurs, movement is in the opposite direction: the distance from front to back is lengthened, the distance from top to bottom is lengthened, and the distance from side to side is shortened. In the extension position the sphenobasilar junction in the clivus is decreased in its upward convexity. This alternating change in shape is a regular physiologic action moved and controlled by the reciprocal tension membrane.

How does this work? I have used the words *automatic shifting fulcrum*. To illustrate what these words refer to, consider the mechanism of this little balance scale that I am holding up. Where is the fulcrum over which the balance operates? Right here, at the point where the beam is suspended. At present, as I hold it, the balance is working automatically in response to the convection currents in the room. Now, as I shift my hold and alter the position of the beam, the balance shifts to another place; every point is in another place and the whole is working over the fulcrum just the same. Yet the fulcrum is a still point around which the balance continues to respond to the air currents.

When the occasion permits, try a little experiment with a balance by placing your finger under the fulcrum. We found a big balance hanging from the ceiling in the Aptuxet Trading Post down on Cape Cod. When everyone took a turn at placing a finger under the fulcrum in that mechanism they felt the vibration; they read the accent of the to-and-fro movement. We all felt the rhythm as the balance swung in the air currents. Then the meaning of a suspension fulcrum became more clear.

Edith Dovesmith, D.O.,[1] from Niagara Falls, New York, likened the action of the to-and-fro movement to a square dance. This picture brings in the rhythm around the necessary balance point in the reciprocal tension membrane. That balance point is the fulcrum around which the action occurs, that shifts automatically from point to point. Even so, the fulcrum remains still — the fulcrum wherein you get the balanced vision.

1 (1895-1970) American School of Osteopathy, 1918.

What do I mean by suspension? I do not mean that the fulcrum is suspended from its attachments. No. The fulcrum is at the point where the falx *adjoins* the "tent." Notice I didn't say *joins*. It is in between, in the area of the straight sinus. Visualize the suspension when you stand on your head and your falx cerebri is suspended from your tentorium cerebelli. When you turn onto your side, one half of the tentorium is suspended from the other half and from the falx cerebri. The same situation exists when you turn onto the other side. When you stand upright, the tentorium cerebelli is suspended from the falx cerebri. In my view, the two "falx tentoria" are suspended from the falx cerebri. See the three falces where they adjoin, and realize the automatic shifting in the balance.

These three "sickles" are formed by a reduplication of the inner wall of the dura mater, the dural membrane. See how they are spread out over the cerebellum and between the hemispheres. Note the state of tension in the membrane. It is always tense. Then note the diversion to form a venous sinus along the superior sagittal suture. See the channel for the straight sinus where the sickles adjoin one another. This venous channel is the most important because it carries the deep venous drainage from the brain. This place naturally, automatically, shifts its position. If it did not there would be an injury where the great cerebral vein of Galen enters the straight sinus.

Harold I. Magoun, Sr., D.O.,[2] was moved to call this important functional point the "Sutherland Fulcrum" when he came to understand the automatic shifting suspended fulcrum in the mechanics of the reciprocal tension membrane. I did not consent to that idea for a long time. Now that I have, I expect to emphasize its significance.

2 (1898-1981) Andrew Taylor Still College of Osteopathy and Surgery, 1924. Dr. Harold Magoun, Sr. was one of the founders of the Sutherland Cranial Teaching Foundation and the author of the textbook *Osteopathy in the Cranial Field.*

* * *

My next talk considers further the relationship between the mobility of the bones and the reciprocal tension membrane. We have noted the reduplication of the inner wall of the dura mater in folds and how they separate to form venous channels. Think of the fact that between these channels, where the walls come together, the membrane is very tense.

What is a *reciprocal tension membrane*? Suppose I put up two poles and connect them at the top with a wire, a tense wire. When I pull one pole it pulls the other with it. Then, I reverse the situation. I pull the poles back to the perpendicular, where I started. This is a reciprocal action, back and forth. The tension in the wire is the pull in the system. That is why I emphasize tension — a reciprocal *tension* membrane between poles of articular attachment — of articular movement in the cranial mechanism.

Editor's Note: The dictionary defines tension as a mechanical stress by which a bar or cord is pulled when it is part of a system in equilibrium or motion.

In a schematic view we have an anterior superior pole, an anterior inferior pole, a posterior pole, and two lateral poles of attachment to the bones of the neurocranium. The schematic idea of a tripod in structure and three sickles in action is to help you visualize the whole. The sickle shape suits the mechanism as it goes forward and swings in an arc; the tips move posteriorly and vice versa. The movement in the cranium is seen as follows: during inhalation the reciprocal tension membrane moves forward in an anterior direction; during exhalation it moves backward in a posterior direction. It is a complicated mechanism when you undertake to visualize it in all three dimensions within the cranium.

Do you see that a fulcrum in this action is necessary? A fulcrum is the still point from which you get the power to lift something heavy. If you want to use a crowbar as a lever to lift something heavy you put it over a still point, a fulcrum, to get the power and the mechanical advantage that you do not have without it. You can shift that fulcrum from place to place and change your operation.

You have a suspension fulcrum in the cranium where the falx adjoins the "tent." Get the intracranial picture so that you understand the necessity of shifting that still point, the fulcrum, in order to move the bones. We have an automatic shifting of the suspension fulcrum during inhalation, exhalation, sidebending/rotation, and torsion. Keep that intracranial picture in your mind so that you can feel it in your technique.

Aim to feel the balance point, the still point, when reducing membranous articular strains of the cranial mechanism. I want you to experience that shifting, changing position. When you do feel the balance point, then see what occurs with the levers over the fulcrum, the tripod. This is a floating thing. Get this important mental picture of the fulcrum automatically shifting. This accommodates the various patterns of the articular mechanism.

Feel. Recognize what you are feeling in the cranium just as you do the tension in the ligamentous tissue in relation to the synovial joints. Know your mechanism by having your fingers constantly feeling, seeing, knowing, and thinking. You need that thinking, feeling touch to know what you feel when you are making a diagnosis of internal or external rotation of the humerus. Then your treatment is not a mere jerk here or a thrust there. The ligaments will do the adjusting for you in either an external or an internal rotation of the humerus if you get the mechanism to the balance point.

How could you know when you get the joint to the balance point if your fingers are not there to feel the ligaments that hold the joint together and allow a range of motion? It is the same when you are diagnosing and treating ligamentous articular strains in the spinal column. It is an *art*. It is a *science* that came from Dr. Still.

Now see what you have in this automatic shifting suspension fulcrum in the reciprocal tension membrane. You have the cerebrospinal fluid and the neural tube. You have the Tide. You cannot only reach the physiologic centers in the medulla oblongata, you can also control, to a certain extent, the movement of the fulcrum where so many strains of the mechanism dwell.

By simply controlling the Tide in the fourth ventricle or with the sacrum, you provide action in the reduction of some conditions in the osseous tissues of this mechanism. By bringing the fluctuation down to the short rhythmic period, the Tide, with its Intelligent potency, shows that it is something you can depend upon, something that knows how.

Your technique is somewhat different when you are dealing with conditions in early life. The mechanism in people farther along in life is operating with the "gears" that have formed in the articular surfaces. You must realize that before these features are formed you have a fluctuation of the cerebrospinal fluid and then the membranes go to work and pull the bones into position.

Consider again those two poles, perhaps telephone poles, with the wire stretching from pole to pole. Think of what happens in a sleet storm. The wires, loaded with sleet and ice, pull the poles out of position. See the same situation when some traumatic force, intracranially during birth or during falls later on, pulls the wire of mother dura and the bones are pulled out of position.

It is necessary to utilize the membranes, the wires, in the reduction of those lesions so as to bring those little bones back into position and relationship. Even following a normal delivery when they have folded to allow a safe passage, you get the baby crying and inhaling so as to fluctuate the cerebrospinal fluid up into the cranium. Then the membranes go to work to pull the bones into position. The power is in the fulcrum, the rhythmic balance. The terminology, *reciprocal tension membrane*, tells you something. That terminology required a depth of study before it could be utilized. It doesn't necessarily have to be applied only to the membranes of the skull. There is a reciprocal tension membrane of the spinal canal.

Where is the reciprocal tension membrane of the spinal canal? It is a continuation of the inner layer of cranial dura mater. It is firmly attached to the rim of the foramen magnum in the occiput, and it goes to the sacrum. The little babes and the children led me to the use of this. All I had to do in treating an infant old enough to crawl on the bed was to hold the sacrum. Do you see that reciprocal tension membrane in the spinal canal connecting the sacrum and the occiput? As the babe walked along, the fluctuation of the cerebrospinal fluid was influenced. The same principle is useful with adults when we have the patient sit on our knees, bend forward to put their arms on the table, and walk away on their elbows while the operator holds the pelvis back. (For a description of the lap technique, see p. 194.)

See what is going on there. The fluctuation of the cerebrospinal fluid is active, the intraspinal reciprocal tension membrane is engaged in changing the position of the sacrum and the occiput. The firm attachment of the membrane around the foramen magnum of the occiput and the attachment to the sacrum in the sacral canal make two connected bones.

When the occipital wheel turns in circumrotation into the flexion position, the foramen magnum is carried to a higher level. (See Figure 1.) This is because of the turning in the direction that produces the flexion position at the sphenobasilar junction. See how that tension lifts the sacrum at the other end. Then, when the occipital wheel circumrotates into the extension position the foramen magnum moves back and drops the sacrum into its extension position. Visualize spokes on the wheel all the way along — the basilar process, the jugular processes, and so forth. Notice the different levels in the inhalation position and the exhalation position.

The function of this reciprocal tension membrane is another principle in the primary respiratory mechanism. The attachments to the bones are not the point. That is the same as the attachment of ligaments to the bones in a synovial joint. The tension is in between, as I have explained in describing the fulcrum, the automatic shifting suspension fulcrum.

FIVE

The Motility of the Neural Tube

When you come to the third principle in analyzing the primary respiratory mechanism you come to a subject that cannot be fully explored in a single lecture. Yet, the motility of the neural tube, that is, the motility of the brain and spinal cord, is an important activity of the living body. It is convenient to start a study of this subject by considering embryology. The formation of the neural tube begins very early in the embryo.

Once there is an embryonic plate with an ectoderm, a mesoderm, and an endoderm, the ectoderm becomes the field of development for the nervous system and the skin. First, along the middle a thickened band appears that is flat. This band then becomes stratified, and the lateral margins grow faster than the central region. The result of this unequal growth is the formation of the neural groove. The groove itself is bounded on each side by an elevated neural fold. As the groove deepens, the neural folds meet and fuse dorsally. This stage establishes the neural tube. At the completion of this process the tube lies below the surface of the ectoderm and is detached from it. The neural crest divides and comes to lie in a dorsolateral position. The ganglion cells of both cranial and spinal ganglia are derived from the neural crest.

The primitive neural tube is formed by the folding of the neural groove into an epithelial tube. The groove begins to close near the middle of the body very early and closure advances progressively in both directions. The caudal end closes off just after the rostral end, and at that stage the formation of the neural tube is complete. The three primary brain vesicles (the forebrain, midbrain, and hindbrain) are formed by the closure and enlargement of the rostral end. The neural tube below these vesicles is smaller in diameter and becomes the spinal cord.

At this early stage, the entire neural tube can be analyzed both by concentric rings and longitudinal strips. The primitive dorsal and ventral walls are primarily ependymal in structure and do not participate in the thickening of the lateral walls. They become the floor plate and the roof plate. The sulcus limitans marks the subdivision into the sensory dorsal plate and the motor ventral or basal plate.

As the neural tube is forming into these basic arrangements of the central nervous system, the surrounding mesenchyme is becoming condensed and arranged into the outer coverings of the brain and spinal cord. These are the meninges and the osseous neurocranium.

> The dura is a hard fibrous enclosing membrane just beneath the bony skull. The arachnoid bridges the brain's many crevices. The pia mater is molded firmly and tightly to dip into every irregularity on the surface of the brain.
>
> There are ridges and valleys on the surface of the brain that are called gyri and sulci. The cerebrospinal fluid is distributed on the outside of the neural tube beneath the arachnoid membrane in the subarachnoid spaces. It is distributed inside the neural tube in the lumen of the tube, the ventricles.
>
> By the time the neural tube is developed and arranged within the skull there are two hemispheres and four lobes of each hemisphere. These are like separate continents bounded by three fissures. It is useful to think of this cerebral geography as long as one remembers that *this map is not the territory*.[1]

1 Adapted from: Richard Restak, *The Brain* (New York: Bantam Books, 1984), pp. 8-14.

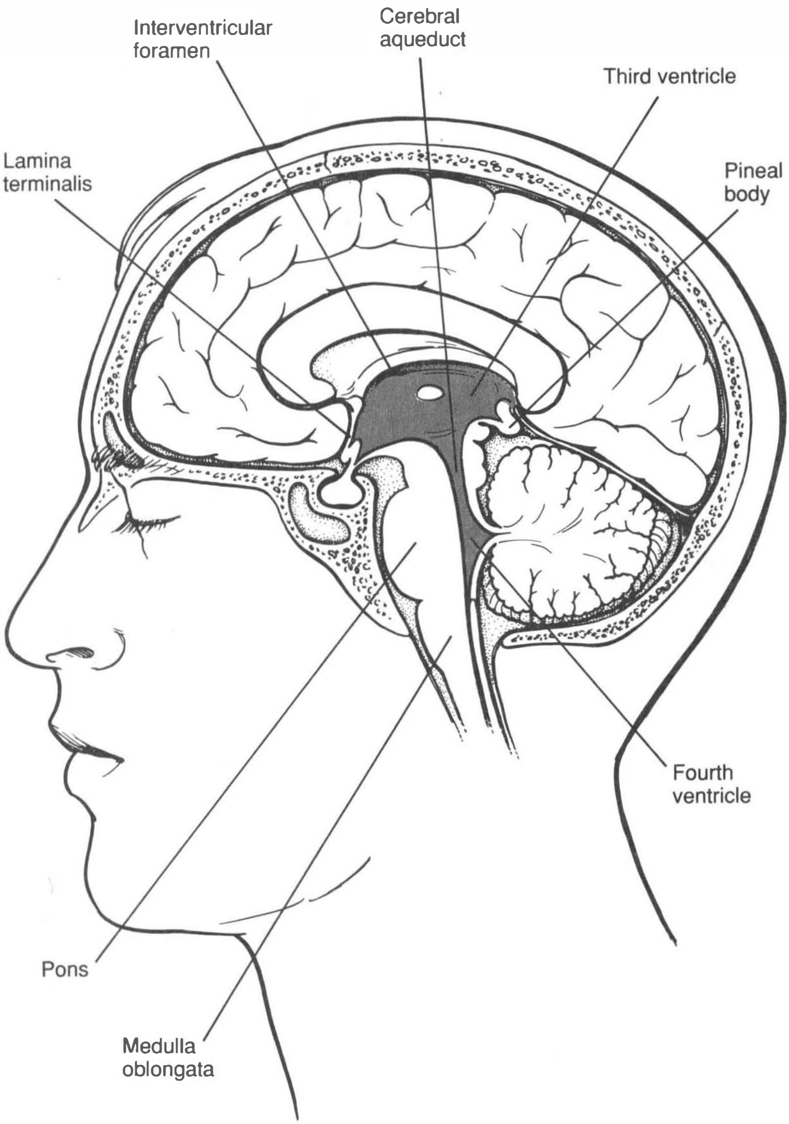

Figure 6. A medial view of the cerebrum.

Below the cerebral hemispheres there is the brain stem and spinal cord. The cerebellum lies over that part of the brain stem that is named the pons and the medulla oblongata. The medulla is just inside the skull at the foramen magnum where the spinal cord expands as it enters. [Dr. Restak refers to this area as the "magic inch." –Ed.] It is where the control centers are located that regulate blood pressure, heart rate, swallowing, vomiting, breathing, talking, and singing. The smallest division of the brain stem is the midbrain, above the pons and connecting to the diencephalon, the first part of the forebrain.

With this brief survey, attention is given to the significance of the physiologic centers in the floor of the fourth ventricle, in that key area (the "magic inch") of the medulla oblongata. The respiratory center here is primary to the diaphragm and the physiology of the heart and lungs. I proved this to my own satisfaction on my own body. It was clear that the centers in the floor of the fourth ventricle are primary and that the function of the diaphragm, heart, and lungs is secondary.

Inside the brain stem the third and fourth ventricles are connected by the cerebral aqueduct in the midbrain. The central canal of the spinal cord lies beyond the fourth ventricle. The fourth ventricle is quite a capacious little ventricle with open doors in the walls. There is quite a bit of cerebrospinal fluid in there. Along the floor and beside it are the nuclei of all the cranial nerves from the third to the twelfth. These provide functions we could not well live without. The medulla oblongata and the pons are the floor of the fourth ventricle.

The fourth ventricle has a roof, and the cerebellum lies above it. All these parts occupy the posterior cranial fossa below the tentorium cerebelli. The midbrain lies in the tentorial notch and just above the sphenobasilar junction on the clivus of the osseous cranial base.

The open doors in the walls of the fourth ventricle allow for the connection between the inside distribution of the cerebrospinal fluid — the ventricular — and the outside distribution

— the subarachnoid. The collection of fluid in the subarachnoid spaces underneath the brain is called the cisterna basalis. That around the brain stem is called the cisterna magna. John Hilton called these cisternae the "water-bed" upon which the brain rests.

> In fact, the central parts of the base of the brain, instead of resting upon the bones of the skull at its base, rest upon this collection of cerebrospinal fluid, which forms for it a most beautiful, efficient, and perfectly adapted water-bed . . .[2]

The brain and spinal cord are of the consistency of soft custard. The whole neural tube is in the protective surround of the cerebrospinal fluid, inside and outside. This whole, wrapped in the leptomeninges (the arachnoid-pia), lives within the osseous neurocranium formed of bones held together by the dura mater and its specializations, the falx cerebri and the tentorium cerebelli. At birth, the whole cranium resembles a soft-shelled egg for there are no joints established between the bones except that between the atlas and the occiput.

Through the functions of the primary respiratory mechanism, the physiologic centers in the medulla relate to the secondary physiology of the living human body. Through this great battery, the Tide, you find the "highest known element" is transmuted to those physiologic centers. The nuclei of the cranial nerves also receive the transmutation from this Tide, from the battery that contains the "juice," distilled from material elements that man utilizes. Do you see all these things just lying there static, as they are found in the cadaver? No. You watch them in inhalation and exhalation, in mechanical functioning.

The living human body is a mechanism that includes not only the osseous articulations but also the flow of the blood in the arteries and veins, the intricate mechanism known as the lymphatic system, the soft tissues, the viscera, and that great hydraulic system, the cerebrospinal fluid.

2 Hilton's book first appeared in London in 1863. A more recent edition was published in 1950: John Hilton, *Rest and Pain*, ed. E.W. Walls, Elliot E. Philipp, H.J.B. Atkins (London: J.B. Lippincott Company, 1950), p. 24.

The central nervous system is a network that not only carries nerve impulses but also has a structure that manifests the physiologic functioning of motility.[3] There are tracts running through the floor of the fourth ventricle. There is movement inside, outside, and in the walls — those walls at the bend and those peduncles and tracts that run up into the cerebellum. Visualize the side walls of the neural tube as having motility as well as the function of carrying motor impulses.

Visualize the changes in shape of the neural tube within the neurocranium and spinal canal that I see as inhalation and exhalation. For example, consider the spinal cord drawing up, like a tadpole's tail, during inhalation and dropping down during exhalation. See a mechanism operating all the way through along with the articular mobility of the osseous mechanism.

Next, I want you to know the construction of the cerebellum as contrasted with the cerebrum. Look at the cerebellar cortex, far from nerve tracts, with cells sticking up there like antennae, like the antennae that some bugs have sticking out in front of them. There are no nerve nuclei up there in the cerebellar cortex. When seen under the microscope the cells up there are not the same as the cells in the nuclei. You can see them move and wiggle like cilia, not like mechanisms made by man.

I begin to see something — a radio station up there, maybe? We know of the long waves that carry messages and of the sending antennae, the receiving antennae on top of your house or barn, and the tuning sets for selecting the station broadcasts you want. Do we have here a pattern for this man-made equipment?

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3 "What gives a cell form may also control its genes. At first glance the cytoskeleton of a mammalian cell would not appear to be closely related to gene expression. The cytoskeleton, a complex network of proteins and other molecules, endows the cell with form and enables it to move. Genes, on the other hand, embody the information needed for making proteins. Contrary to expectation, however, the cytoskeleton appears to be a crucial intervening actor in the control of gene expression." John Benditt, "The Genetic Skeleton," *Scientific American* 259 no. 1, (July 1988), p.40.

I want you to visualize the motility in that cerebellum, somewhat like the bellows used in the blacksmith's shop to blow on the fire. They are one shape in inhalation and another shape in exhalation. Motility, not mobility, accounts for this. Follow those little layered tracts called the peduncles. Note how they run down the spinal cord, beneath and around the pons, around the fourth ventricle, and up along the midbrain to the connections to the pineal body.

Imagine my outstretched arms as one of the cerebellar peduncles (brachium pontis). The pons is in my fingers; my elbows can cause contraction of the fourth ventricle; then I can release them, and it dilates. Here is a contracting motility, the primary respiratory mechanism. Become aware of the motility, which is separate from the movement related to the inflow and outflow of blood. That is also a physiologic movement. Surgeons see the movements of the living brain related to blood flow; I am not talking about that.

I am talking about a physiologic motility — the tracts moving in there as well as the movements of the convolutions. The tracts have motility in addition to their function of carrying nerve impulses. Take the cerebral aqueduct, for instance; see that it is not a hollow stationary tube. Note the action of its walls so that it can change to allow the cerebrospinal fluid to go through it. Look at other tracts and at the convolutions in their local connections. You can reason with the mechanism and see no limit.

At the roof of the third ventricle at the junction of the midbrain with the diencephalon is a little thing called the pineal body. Various names and functions have been assigned to it, but the view of it as a material thing in a particular location where it can have a mechanical function is not mentioned. When I look at it that way I see a little cone with a stem. It has a recess that opens to the third ventricle. If you were inside the third ventricle you would see it up on the roof. It is the same as the situation down at the bottom where the infundibulum goes through the diaphragma sella to the inside of the posterior lobe of the pituitary body (the neurohypophysis).

There is an outside as well as an inside of the pituitary body and of the pineal body. The inside of these bodies is the inside of the neural tube, directly connected to the third ventricle. The outside of the pineal body is in the subarachnoid cistern located in the great transverse fissure of the brain. This is called the superior cistern. The great cerebral vein of Galen is also there before it enters the straight sinus. The little cone is just above the superior colliculi on the roof of the midbrain. It can move as the third ventricle widens into its V-shape with inhalation and back into the narrow slit with exhalation. That is, with the motility of the neural tube the pineal body can flip-flop up and down. It is a different picture in the living than in the cadaver.

I want you to realize how that cone, the whole outside of the pineal body, flops over onto the superior colliculi so that the position in the cadaver is not the same as the position in the living brain when the roof of the third ventricle spreads out in inhalation. In the "Tour of the Minnow" I note that the little fish, when swimming in the third ventricle, can find the pineal recess and blow into it. (See Chapter 17.)

There is a choroid plexus on the roof of the third ventricle with tela choroidea. This is on the outside of the neural tube. There is a curtain between that and the inside of the third ventricle. Some say the cerebrospinal fluid is produced there. When seen in the cadaver, however, that choroid plexus is all bunched up.

I found out when I went through certain experiments that during inhalation a change occurs in the walls and roof of the third ventricle. That change is the roof stretching out as the ventricle becomes V-shaped. There the process of interchange may be a little mechanism similar to the one in the kidneys where an

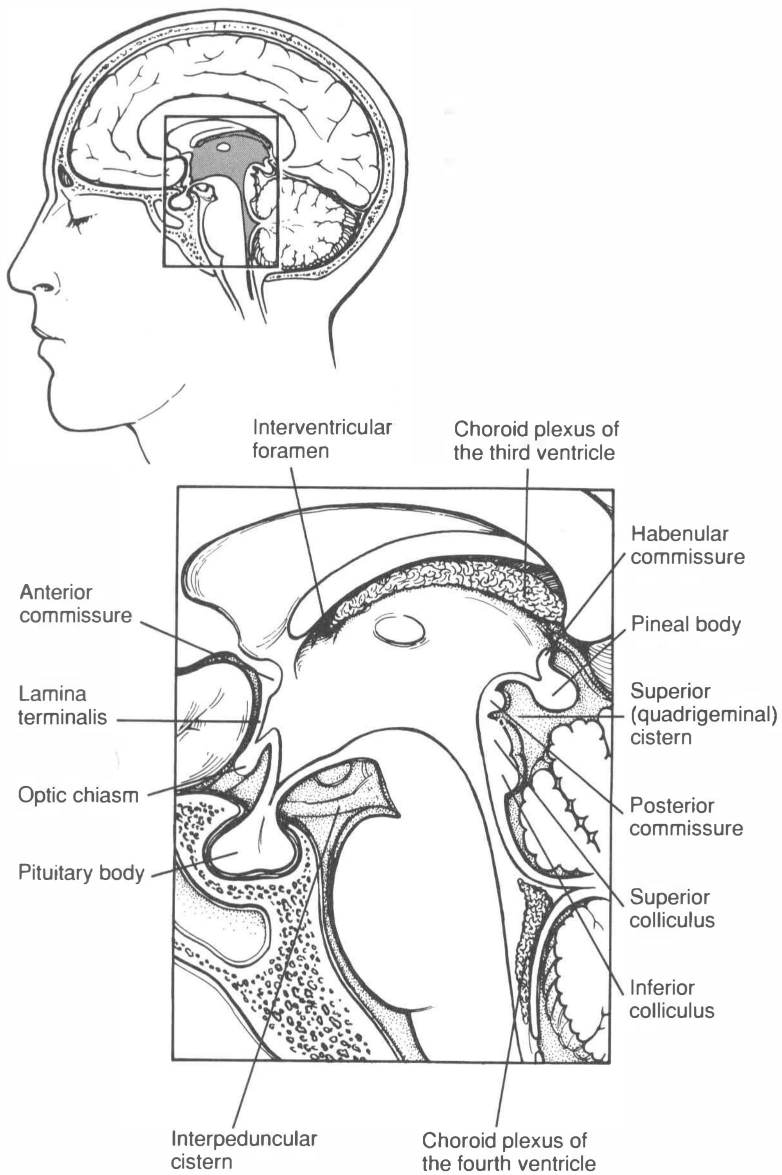

Figure 7. A cross-section of the region of the third ventricle.

interchange occurs between the fluids of the body. In the choroid plexuses the interchange is between the blood and the cerebrospinal fluid, not a manufacturing of the fluid. You would have a hard time replenishing the waters of the brain through such a process. It is a mechanism for the interchange between all the fluids of the body. Put something into the cerebrospinal fluid and you will find it in the blood later.

> The roof of the diencephalon is largely formed by a layer of ependyma which is continuous with that lining the remainder of the third ventricle. This ependyma is in close association with the overlying vascular pia mater. In the caudal part of the roof and in the adjoining lateral walls of the diencephalon are the habenular nuclei and their commissure, the epiphysis cerebri or pineal body, and the posterior commissure. Together they constitute the epithalamus. The habenular and posterior commissures cross the midline in the cranial and caudal laminae of the pineal stalk.
>
> The pineal body is a small, piriform, reddish-gray organ that occupies the depression between the superior colliculi. The pineal body measures about 8 mm in length, and its base, directed anteriorly, is attached by a peduncle, or stalk, that divides anteriorly into two laminae, superior and inferior, that are separated from each other by the pineal recess of the third ventricle. The inferior lamina contains the posterior commissure and the superior, the habenular commissure. Nerve fibers enter the dorsal or dorsolateral aspects of the body from the region of the tentorium cerebelli where they form a single or paired nervus conarii. This runs in a subendothelial position in the wall of the straight sinus and its fibers are derived from the cells of the superior cervical ganglion. The nerve fibers are adrenergic sympathetic elements and run in association with blood vessels and parenchymal cells.[4]

Do you see the roots of the pineal structure interlaced with the walls of the cerebral aqueduct, fibers in the wall that travel back and forth in the roots of the anterior lobe, the old area, of

4 Adapted from: Henry Gray, *Anatomy of the Human Body*, 26th ed., ed. Charles Mayo Goss (Philadelphia: Lea and Fabiger, 1954), pp. 891-898.

the cerebellum? This is a mechanical "gear-shift," if you want to call it that. I mean a strategic shifting of the mechanics of the brain stem, including the cerebellum, working in correlation with the motility of the cerebellum, widening the aqueduct. See this working in conjunction with the third ventricle.

Consider the bottom of the third ventricle and the infundibulum. The infundibulum connects the hypothalamus with the pituitary body. The pituitary body is strapped down in the sella turcica by the diaphragma sella. That is on top of the body of the sphenoid bone, which circumrotates to and fro on its transverse axis.

When the bottom of the third ventricle moves upward, like the tadpole's tail, as the inhalation phase makes the V-shape of the ventricle, the infundibulum moves upward in an arc with the sella turcica as the sphenoid circumrotates into its flexion position. This is another area of many important nuclei. There are both functional and structural connections. There is an interlacing of fibers that go along the wall of the aqueduct and even run back to the cerebellum. Realize how the motility in the brain stem and cerebellum includes the areas where the physiologic centers and cranial nerves are located.

Editor's Note: Dr. Sutherland is emphasizing the importance of considering the mechanical action. He taught that the mobility of the pituitary body within the sella turcica was essential to its function.

Now, stretch your imagination. I won't say that you can do it immediately, but you can recognize that this area is the material mechanism for your walk about on earth. Do you think it possible to shift that "gear" mentally? Is it possible to flip-flop that pineal body merely as a mechanism? If you want to, you can go up there and lock it so that fluctuation of the cerebrospinal fluid is stalled and motility in the body is stalled. In such a case the condition that Dr. Still called a "withering field" would result.

> He who is able to reason will see that this great river of life [the cerebrospinal fluid] must be tapped and the withering field irrigated at once, or the harvest of health be forever lost.[5]

Think of the distribution of the cerebrospinal fluid on the outside of the brain stem and cerebellum. It is all around, peeping into every recess; it curls up and around and out, all the time in the subarachnoid space on the outside of the brain. Consider the cisterna basalis, the cisterna chiasmaticus, the cisterna interpeduncularis, and the cisterna magna.

Think of the motility of the cerebellum in those little layered tracts called the peduncles, in the roof of the midbrain, and the pineal body. Think of the motility in the tracts running down the spinal cord and going around the fourth ventricle and beneath the pons. Can you now see the mechanical physiology in the functioning of the primary respiratory mechanism?

Next, think of the picture of the membranous tissues that form the venous channels. Think about restriction in these channels that might lead to pathology in the brain. This thinking indicates many of the possibilities offered through the practice of the science of osteopathy as envisaged by Dr. Andrew Taylor Still. Carry this picture in your professional mind as an aid in the diagnosis and treatment of the problems that your patients bring to you.

* * *

Another place where you can control the Tide is in the lateral ventricles. The two ventricles are in the cerebral hemispheres. They go beyond the lamina terminalis through the interventricular foramina. The motility of the brain stem and spinal cord ends at lamina terminalis. These foramina are located high in the end wall of the third ventricle. The lateral ventricles extend out from the third ventricle along the neural tubes of the

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5 Still, *Philosophy and Mechanical Principles of Osteopathy*, p.45.

hemispheres. Note the spiral form that the cerebral cortex, the telencephalon, makes on each side as it fits into the cranium above the tentorium cerebelli. Remember that the falx cerebri is placed in the middle between the cerebral hemispheres.

What is the mechanical significance of the spiral form? Do you see the changes that coiling and uncoiling can produce? Realize that the ventricular distribution of the cerebrospinal fluid is inside the neural tube and that the subarachnoid distribution is outside the neural tube. All of this is just under the cranial vault that is easily accessible to manual contact. You can hold the vault in the exhalation phase by holding the posterior inferior angles of the parietal bones medially and having your patient exhale. The principle is the same as the operation for compression of the fourth ventricle. It is most practical, usually, to compress the fourth ventricle because there you have an influence on all the physiologic centers, including that of respiration.

Now, think of that drug store that Dr. Still wrote of in his autobiography:

> [I] further proclaimed that the body of man was God's drug store and had in it all liquids, drugs, lubricating oils, opiates, acids, and antacids, and every sort of drug that the wisdom of God thought necessary for human happiness and health.[6]

Consider the choroid plexuses where you have that interchange between all the chemicals, between the cerebrospinal fluid and the arterial blood stream. See what you are getting: an interchange between the chemicals in the cerebrospinal fluid and those in the blood, if you can look at it in that manner. You become the pharmacist in the drug store mixing the chemicals in the cerebrospinal fluid and in the blood, all at the same time.

Then, don't forget that "highest known element," that "fluid within a fluid" that nourishes what? The nerve cells that carry impulses along the nerve fibers by a transmutation. Also, don't

6 Still, *Autobiography of A. T. Still*, p. 182.

forget that "finer nerves dwell with the lymphatics." When you tap the waters of the brain by compressing the fourth ventricle, see what happens in the lymphatic system. Visualize the lymph node that is holding some poison that has gathered there, changing the constituency before the lymph is moved along into the venous system.

Once more, think of the brain and spinal cord, the central nervous system, as part of the primary respiratory mechanism. Recognize the motility of the whole neural tube, the tracts as well as the convolutions, in the living context of all the movements of the brain. See the change in the spinal cord, cerebellum, and brain stem up to the lamina terminalis. See the coiling and uncoiling of the spirals of the cerebral hemispheres based at the interventricular foramina.

Consider the cerebral aqueduct, for instance, and see that it is not a hollow stationary tube, but the ventricle of the midbrain, and that there is motion in its walls so that as it changes its shape, fluid may move through it. As I have said, you can reason with this mechanism and see no limit.

A cast of the ventricular system of the human brain looks like a bird to me. It reflects the interior of the brain. The third and fourth ventricles can be the body of the bird, and the central canal of the spinal cord, the tail. The lateral ventricles look like the wings of a bird and are attached up where the wings of a bird would be, off the anterior superior angle of the body. Put a hemisphere on each ventricle and you have two wings for this bird. These are attached at the top of the lamina terminalis, the front wall of the third ventricle, which is a chamber for fluid.

I want you to see those things in the inhalation phase, doing the same as a bird does when it goes into flight. At that moment, the wings glide up a little more posteriorly than they do in front. What does the bird do when it lights on a twig but fold down in exhalation?

SIX

The Articular Mobility of the Cranial Bones and the Involuntary Mobility of the Sacrum

Editor's Note: This chapter concerns the subject Dr. Sutherland expressed first in his cranial concept in the science of osteopathy. In the later years of his teaching he often assigned it to members of his associate faculty. Because of that policy there is little of his own speaking on this subject on the tapes that were recorded in 1949 and 1950. In consequence I have used his written words[1] where his speaking was lacking.

My activities in cranial articular mobility date back to 1899 while I was a student at the American School of Osteopathy in Kirksville, Missouri. The idea originated while I was viewing the disarticulated bones of a skull belonging to Dr. Andrew Taylor Still on exhibition in North Hall of the A. T. Still Infirmary building. The articular surfaces of those bones seemed to me to indicate that they were designed for articular mobility. I found that anatomical texts, while describing bones thoroughly as to shape, as well as to their external and internal surfaces, had very little to tell concerning the surfaces, which to the student of osteopathy were the most important of all — the articular surfaces.

The study of the animate skull and of applied anatomy indicates a great difference in the texture of tissues in the living as

1 Adapted from Sutherland, *The Cranial Bowl* and *Contributions of Thought*.

compared with the same anatomical tissues in the cadaver. I view the cranial articular structure and the involuntary mobility of the sacrum between the ilia as a functioning mechanism of the living human body.

Editor's Note: The anatomists' study of the cadaver led to a view different from Dr. Sutherland's study of a living mechanism:

> It is, generally speaking, much more important to be familiar with the skull as a whole than with the individual bones that comprise it, because (except in the cases of the mandible and the ossicles of the ear) the bones are united to each other by either suture or synchondrosis and there is no movement between them. Muscle attachments, bony fossae, bony lines and ridges, blood sinuses, fasciae, and so on extend from bone to bone without respect to such joints, so the locations of the immovable joints that outline the individual bones are of little account.[2]

Articular mobility occurs in the basilar area, as well as in the facial bones; the basilar mobility being accommodated through compensatory expansile and contractile service at the vault sutures. I view the cranial articular structure as part of a primary respiratory mechanism, and see that it functions in conjunction with the brain, the ventricles, and the intracranial membranes.

The total bone area of the cranial articular surfaces is greater than that of the sacroiliac joints. There are many separate articular surfaces in the cranial field, while at the sacroiliac joints there are two. The separate articular surfaces must be considered as a whole in the mental picture of the cranial articular mechanism. This knowledge can be obtained only through intensive study of the articular surfaces as they are found on the separate bones of a disarticulated skull. Anatomical texts are lacking in this information.

2 J.C. Boileau Grant, *A Method of Anatomy*, 4th ed. (Baltimore: The Williams and Wilkins Company, 1948), p. 785.

It is convenient to describe cranial articular mobility in three divisions, but it is necessary to remember that the whole includes the parts and that the action occurs simultaneously in all parts.

1. The cranial base includes the occiput, the sphenoid, the ethmoid, and the two temporal bones.
2. The cranial vault includes the interparietal occiput, the frontal bone(s), the two parietal bones, part of the squamous portions of the temporal bones, and the tips of the greater wings of the sphenoid.
3. The bones of the human face are the vomer, the mandible, the two zygomatic bones, the two palatine bones, the two lacrimal bones, the two nasal bones, the two maxillae, and the two inferior turbinates.

Editor's Note: The following excerpts from several texts cover the basic anatomical information that Dr. Sutherland usually referred to before lecturing on the subject of mobility between the cranial bones at the sutures.

> The chondrocranium, as it is termed, is thus confined chiefly to the base of the skull, whereas the bones of the sides, roof, and the face will be of membranous origin. . . . Ossification of the chondrocranium begins early in the third [fetal] month but some membrane bones are even more precocious.[3]
> It is evident that although the bones of the base arise chiefly in cartilage, they receive substantial contributions from membrane. The remainder of the sides and the entire roof of the skull are wholly of membranous origin.[4]
> In general the older portion is preformed in cartilage whereas the newer facial and roofing bones are formed intramembranously.[5]

3 Leslie Brainerd Arey, *Developmental Anatomy* (Philadelphia: W. B. Saunders, 1931), p. 317.
4 Ibid., p. 319.
5 Bradley M. Patten, *Human Embryology* (Philadelphia: Blakiston Co., 1946), p. 277.

The Sphenoid Bone

> The sphenoid bone is situated at the base of the skull in front of the temporals and the basilar part of the occipital. It somewhat resembles a bat with its wings extended, and is divided into a median portion or body, two great and two small wings extending outward from the sides of the body, and two pterygoid processes which project from it below. . . . The sphenoid articulates with twelve bones: vomer, ethmoid, frontal, occipital, two parietals, two temporals, two zygomatics, and two palatines.[6]

The sphenoid bone is important in the articular mobility of the cranial membranous articular mechanism. When properly disarticulated, the junction of the back of the sphenoid body with the front of the basilar process of the occiput, the sphenobasilar junction, displays a joint of significance. It seems to me to be a modification of the typical joint between the bodies of vertebrae. I have a valuable specimen that I have used in demonstrating cranial technique in which there is clear evidence of an intervertebral disc. This specimen is probably that of an adult between twenty-five and thirty years old.

Editor's Note: The junction between the sphenoid and the occiput in the clivus is a synchondrosis. That is, initially there is an intervening hyaline cartilage that later in life is converted into cancellous bone. This conversion is generally not completed until 25 to 30 years of age. Dr. Sutherland believed that the cancellous bone that was formed maintained a degree of flexibility throughout life.

This sphenobasilar junction, this articular area, is in the clivus, which has an upward convexity. The motions provided here are flexion, extension, side-bending/rotation, and torsion. I have found several adult articulated skulls in which I was able to secure movement between the sphenoid and the basilar process of the occiput by a mere manual compression. At the same time

6 Gray, *Anatomy of the Human Body*, pp. 213- 214.

I noted a gliding movement of the squamous portions of the temporal bones upon the parietal bones and a widening of the sphenomaxillary fissure in the floor of the orbital cavities.

I have also demonstrated the movements of flexion, extension, side-bending/rotation, and torsion between the sphenoid and the basilar process of the occiput in living people late in life. I visualize an intervertebral disc at the sphenobasilar junction as present in young adults and thereafter a mere moveable articulation that functions in the same patterns.

The superior articular surface on the greater wings of the sphenoid contact a small L-shaped articular surface on the under surface of the frontal bone(s). These two frontosphenoidal articulations, though much smaller, resemble the two sacroiliac articulations. It seems that the sphenoid is suspended beneath two frontal bones in a like manner to the suspension of the sacrum beneath the two ilia.

Editor's Note: Dr. Sutherland found it useful to distinguish between the frontal bone as one structure and the two halves that function as two, mechanically. Just as the two greater wing-pterygoid units of the sphenoid bone may function in mobility in relation to the body of the sphenoid, it is clear that the relation with two frontal bones is comparable to paired lateral structures. A review of frontal bone anatomy may be useful in making this distinction:

> Ossification is in membrane and begins in the 7th fetal week at the eminences. At birth the frontal bone is in two halves; these fuse at about the fifth year at the interfrontal or metopic suture. Remnants of this suture persist at the glabella.[7]

The two L-shaped frontosphenoidal articulations probably serve as a fulcrum that accommodates mobility at the various articulations of the sphenoid. Posterior to these L-form areas there is a change in the bevel of the surfaces that articulate the frontal and parietal bones. This indicates gliding mobility.

7 Adapted from: Grant, *A Method of Anatomy*, p. 786.

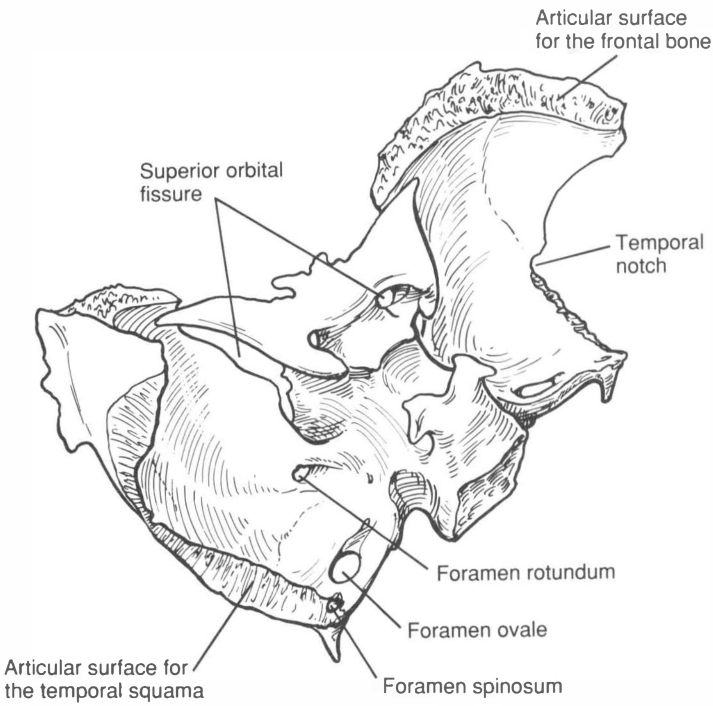

Figure 8. The sphenoid bone, showing the L-shaped surface for articulation with the frontal bone and the change in bevel in the sphenosquamal articular surface.

The posterior articular surfaces of the greater wings of the sphenoid begin in a sharp angle where the superior surfaces end. In your study of the disarticulated skull bones, notice the places where a change occurs in the bevel. This posterior articular surface continues until a change occurs midway. Beyond that the bevel of the lower half continues. At the midway point there is a small niche. The posterior articular surface of the greater wings of the sphenoid bone articulates with the anterior articular surface of the squamous portions of the temporal bones. The angle niche on the sphenoid is connected to an angle projection on the squamous portion of the temporal bones.

Above the midway point the greater wings are beveled at the expense of the outer surface, and the squamous portions are beveled at the expense of the inner surface. Below the midway point the opposite form of beveling occurs. The significance of this characteristic of the sphenosquamal articulations should be studied minutely.

This articular contact between the sphenoid and the temporal bones presents a mechanical principle that, in itself, without reference to other features, portrays the design for articular mobility between the bones of the cranial base. This interesting articular surface generated the initial thought that implied the possibility of cranial articular mobility for me. The study of minute characteristics is necessary for forming a mental picture that will lead to the diagnosis of membranous articular strains of the cranium and to their treatment.

The Temporal Bones

Because the two temporal bones are of singular importance in the articular mobility of the cranial base, they come next in our study. Consideration of one will serve for both. The squamosal suture attracts attention first. It is beveled at the expense of the inner table continuously from the midway point in the sphenosquamous suture and along the side of the head where it overlaps the parietal bone in the squamosal suture. This arrangement indicates a gliding mobility between the side of the parietal and the squama of the temporal bone, extending back as far as the parietal notch and the parietomastoid suture.

As the temporal bone moves, the superior articular surface of the mastoid portion carries the posterior inferior angle, the mastoid angle, of the parietal. This parietomastoid articulation presents corrugations, or grooves, that show the action occurring here, and also indicates the direction of the movement. It is a kind of rocking movement.

Moving further posteriorly around the temporal bone, the superior articular surface changes at a sharp angle to become the posterior articular surface with the occiput. The contact of the posterior articular surface with the occiput is an internal bevel on the mastoid portion of the temporal bone and an external bevel surface on the jugular process of the occiput. It presents grooves and serrations that provide a fulcrum arrangement for accommodation to the rocking movement of the temporal bone.

The facing on the articular surface of the mastoid portion of the temporal bone and on the articular surface of the occiput in the occipitomastoid suture is an important point to be studied carefully. On the lateral part of the occiput the bone is concave and presents a lateral facing on its articular surface. On the mastoid portion of the temporal bone the shape is elliptical and the facing is medial.

At the terminus of the elliptical area there is a groove immediately posterior to the jugular notch. On the basilar process of the occiput there is a fulcrum contact with this groove. I call it a fulcrum because of the mechanical service the crosswise placement of the groove and fulcrum offer to the rocking of the temporal bone. In my early writing I called this area and the lambdoidal suture area a "combined rockshaft and pivot-bearing mechanical arrangement" for the action in the articular mobility of the cranial base.

Editor's Note: Mechanically speaking, a rockshaft is an oscillating rod used to transmit motion, as in the connection between an engine and a wheel. The end of the shaft rests and turns in a bearing that functions as a pivot — the area around which the rod rotates or oscillates. Dr. Sutherland viewed the occiput as the pivot-bearing part and the temporoparietal mechanism as the rockshaft.

The Vault Bones

The study of the skull cap begins with noting the sutures around the parietal bones. The squamosal and parietomastoid connection with the temporal bones has been considered. Now look at the lambdoidal sutures between the occiput and the two parietal bones. The lambdoidal sutures curve outward and downward from the superior angle of the occipital squama at the lambda. Together they resemble a wishbone. The articular surface in the upper part of each lambdoidal suture is beveled at the expense of the internal table so that in this medial region the squama of the occiput overlaps the two parietal bones. In the lower part of the lambdoidal suture, the opposite situation exists. Observe carefully how these changes in beveling serve to accommodate articular mobility between the bones of the cranial base. There are variations in the bones of this area. Sometimes the interparietal occiput is a separate bone and often there are numerous sutural bones. These variations seem to only add to flexibility.

The study of the sagittal suture common to both parietals is especially revealing of an indication for motion between them. Beginning at the bregma, where the sagittal meets the coronal suture, the serrations are fine and close together for about a third of the way. Then the serrations become marked by wider and fewer indentations. As the lambda is approached in the posterior third, the serrations are even further apart. This variation indicates to me a provision for a wider expansile area in the posterior third of the sagittal suture in cooperation with expansion at the lambda.

The serrated articular surfaces of the coronal suture between the frontal squama and the two parietal bones shows the same changes in beveling noted in the lambdoidal suture. The result is that the frontal overlaps the parietals medially and the parietals overlap the frontal laterally, to the anterior inferior angles of the parietals. You might view the frontal bone(s) as being hung on the parietals at the bregma and then hinged so as to have the function of swinging forward or backward at its own lower area. This fact may be of great importance in situations where an external force upon the forehead has wedged the frontal into the coronal between the parietals. In such a case, the frontal causes articular fixation of the greater wings of the sphenoid. That condition limits the normal range of motion in the cranial base.

Here, we are looking at the frontal squama as one bone, as it anatomically is in most adults. In the infant the anterior fontanelle is located here, and the aspect of the two halves of the frontal is predominant.

Remember Dr. Still's dictum, "An Osteopath reasons from his knowledge of Anatomy. He compares the work of the abnormal body with that of the normal body."[8] He also said that we must know the position and purpose of each bone and be thoroughly acquainted with each of its articulations. We must have a perfect image of the normal articulations that we wish to adjust. The cranium is an intricate mechanism and requires detailed study of its complicated articular surfaces.

Observe the L-shape of the frontosphenoidal articulations, one for each greater wing. At birth there are no established articulations in the head other than the occipitoatlantal, and there are, in effect, two frontal bones. Occasionally there are two in the adult when the metopic suture persists. In this connection with the greater wings of the sphenoid the distinction of the two halves of the frontal is functionally important. We may reason on the basis of two frontal bones.

We may consider the midline action of both the sphenoid and the sacrum by noting certain similarities in their relations. The sphenoid is suspended beneath the two frontal bones in the L-shaped articulations. The sacrum is suspended beneath two ilia in the L-shaped sacroiliac articulations. Both these midline bones move to and fro and also have a turning movement in their articular mobility.

8 Still, *Osteopathy: Research and Practice*, Paragraph 10.

Editor's Note: It is sometimes helpful to consider the architecture of the cranium in terms of essential support. The atlas supports the whole head at the top of the vertebral column where the condyles of the occiput fit into the facets of the atlas. The design here, for stability and balance that permits a normal range of motion between the atlas and occiput, is the commonly-found architecture of anterior convergence/posterior divergence. Because the facets of the atlas are also converging inferiorly and diverging superiorly, the motion permitted is the simple nodding motion that says, "yes."

So, the atlas supports the occiput, and the occiput supports the temporal bones. Thus, if the occiput is turned on its anteroposterior axis so that the basilar process is up on one side and down on the other, the temporal bones are carried with it automatically. This is not the same event as the articular motion between them. The temporal bones support the parietal bones at the parietomastoid suture, and the frontal bone(s) from which the sphenoid, ethmoid, and facial bones are suspended is supported by the parietals at the bregma.

The Facial Mechanism

Observe the little flat process on the middle of the anterior superior area of the body of the sphenoid, the ethmoid spine. This fits into a small groove upon the middle of the posterior superior area of the ethmoid. It provides the mechanical arrangement for movement of the ethmoid when the sphenoid moves downward in front. Immediately lateral to the ethmoid spine, on the superior articular surface of the lesser wings of the sphenoid, the sphenoid articulates with the posterior articular surfaces of the orbital plates of the frontal bone(s). The ethmoid notch of the frontals is between the two halves of the orbital plates. This articulation between the lesser wings of the sphenoid and the frontal bone(s) shows evidence that indicates lateral movement during inhalation and medial movement during exhalation. The tips of the lesser wings are not articular.

The sphenoidal crest in the midline on the anterior surface of the body of the sphenoid articulates with the perpendicular plate of the ethmoid which forms part of the septum of the nose. The vomer articulates with the rostrum of the undersurface of the sphenoid body. The vomer forms another part of the septum of the nose and articulates with the perpendicular plate of the ethmoid. The rostrum is a beak-like process that receives the cup-like surface formed by the alae of the vomer. The movement of the vomer and the rostrum resembles a universal joint.

The vomer and the perpendicular plate of the ethmoid extend forward over the palate, which is formed by the horizontal plates of the palatine bones and the maxillae. The nasal cartilage completes the formation of the nasal septum. These structures complete the midline in the cranial base and face.

The sphenoid bone supplies the movement that occurs between the bones of the facial mechanism. It does not, as a rule, articulate with the maxillae. Neither do the temporal bones articulate with the maxillae. The zygomatic bones and the palatine bones serve as intermediaries in this area.

The zygomatic bones hang from the lateral ends of the supraorbital ridge of the frontal and so form a third of the rims of the orbits. The maxillae hang by their frontal processes from the frontal bone(s) in the nasal notch and articulate with the nasal bones, which are situated between them. The zygomatic processes of the temporal bones articulate with the temporal processes of the zygomatic bones in the zygomatic arches on the sides of the head. The greater wings of the sphenoid articulate with the zygomatic bones in the lateral walls of the orbits. The zygomatic bones articulate with the top of the bodies of the maxillae.

As the sphenoid turns forward, downward, and outward in its flexion motion, the greater wings swing the zygomatic bones outward into their position of external rotation, thus widening the orbital cavities. As the front of the sphenoid rises in its extension motion, the greater wings draw the zygomatics inward, narrowing and deepening the orbital cavities. As intermediaries between the maxillae and the temporal bones, the articulation between the zygomatics and the temporals serves variously in accommodation. The composite action between the zygomatic bones and the bones of the cranial base can be realized in the changes in the sphenomaxillary fissures in the floor of the orbital cavities.

The palatine bones are situated at the back part of the nasal cavity between the maxillae and the pterygoid processes of the sphenoid. They contribute to the walls of three cavities: the floor and lateral wall of the nasal cavities, the roof of the mouth, and the floor of the orbits. They enter into these three fossae and one fissure — the inferior orbital fissure. On the posterior surface two furrows articulate with the tips of the pterygoid processes. The pyramidal processes complete the lower part of the pterygoid fossae. The vertical part presents the orbital process, which is located at the very back of the floor of the orbits. The horizontal part, together with the horizontal part of the maxillae, forms the floor of the nose and the roof of the mouth.

The pterygoid plates, medial and lateral, on both sides are convex in shape and hang down from the bottom of the body of the sphenoid. When the sphenoid turns forward and down at the greater wing area, these processes move backward. On each side the tips of the pterygoid processes move like rockers in the furrows on the back of the palatine bones. When the sphenoid turns backward and up at the greater wing area, the tips of the pterygoid processes move forward in the furrows on the back of the palatine bones. (See Figure 9.) Study the anatomical detail of this articular area including the surfaces between the palatine bones and the maxillae.

The sphenopalatine ganglia are located in the pterygopalatine fossae. (See Figure 10.) They hang by two roots from the maxillary nerves that pass across the top of the fossae to go around the orbital processes of the palatines before they enter the maxillae as the infraorbital nerves. Think in terms of motion and study the mechanics of these parts. With some understanding of the normal you will see that articular fixation can crowd the sphenopalatine ganglion and disturb its function.

A mechanical service of the palatine bones follows from the fact that they fit in between the sphenoid and the maxillae. All three bones are located in echelon at the back of the face. The sphenoid is higher than the palatines, and the palatines are higher than the maxillae. The to-and-fro turning of the sphenoid has a greater excursion than the movement of the palatines, and the palatines have more motion than the maxillae. Thus, the service provided is that of a "speed-reducer." We have already studied the other intermediary, the zygomatic bones.

The orbital cavities are not like the acetabulae of the innominate (pelvic) bones. They have a design for mobility. Four of the extrinsic muscles of the eyeball, the recti, are attached to a cuff at the roots of the lesser wings of the sphenoid around the optic foramina. As the sphenoid moves forward, the eyeballs move forward also. As the sphenoid moves backward, the eyeballs move backward also. Observe the superior orbital fissure between the greater and lesser wings of the sphenoid and then the inferior orbital fissure between the sphenoid and the maxillae. Note that the ophthalmic veins lead into the cavernous sinuses that form at the superior orbital fissures. Consider the function of mobility in the walls of the orbital cavities in relation to venous drainage.

Recall that the auditory tubes have an osseous part leading out of the middle ear, a cartilaginous part formed next by the petrous portions of the temporal bones and the posterior borders of the greater wings of the sphenoid, and a membranous part in the walls of the pharynx leading to the fossae of Rosenmuller. It is my belief that the internal and external rotation of the petrous portions of the temporal bones function to open and close the mouths of the auditory tubes. In the case of a lesion fixation that limits the movement of the petrous portions of the temporals and the greater wings of the sphenoid, the effect on the cartilaginous portion of the tubes may hold the mouth of the auditory tubes open or closed.

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SEVEN

The Applied Anatomy of the Human Face

THE HUMAN FACE IS an especially delicate and intricate mechanism. I am reminded of a saying by Dr. Andrew Taylor Still, "It is the little things that are the big things in the science of osteopathy." Study the delicate, intricate, little things in the facial mechanism and begin to apply the mechanical physiology of the region. This is applied anatomy. It is the subject that we studied under Dr. William Smith in the early days at the American School of Osteopathy in Kirksville, Missouri. If you didn't apply that osteopathic physiologic reasoning, Dr. Still was often there, with his walking staff, to see that the members of the faculty regularly brought in the osteopathic point of view.

Editor's Note: In the courses that were recorded, Dr. Sutherland gave two separate lectures on the subject of the facial mechanism. There is some overlap in the two; however, both lectures are incorporated in order to give the fullest picture.

The Ethmoid Region

There is a little thing behind the face that is a big thing, namely, the ethmoid spine on the anterior superior surface of the body of the sphenoid. That little "jigger" fits a groove in the middle of the back part of the superior surface of the ethmoid bone. This mechanism is operated by the sphenoid bone. You understand that the ethmoid is a bone of the cranial base. This arrangement in itself portrays a mechanical principle that indicates articular mobility of the cranial bones, to say nothing of the multitude of other articular surfaces with the same indication.

Look at the cribriform plate of the ethmoid and see that when the front of the sphenoid body goes down, the back of the ethmoid also goes down, and the little ethmoid spine signifies the action. (See Figure 5.) When this plate goes down in back, it goes up in front. What is situated on this cribriform plate? The olfactory bulbs, which are an extension of the brain. The name *cribriform* means sieve, and the olfactory nerves come through the sieve from the upper mucosa of the nose. What does this rocking motion of the cribriform plate contribute to the physiologic functioning of those structures?

The perpendicular plate of the ethmoid is articulated with the sphenoidal crest on the front of the sphenoid body. The crista galli of the ethmoid is the upward extension of the perpendicular plate, and this is the anterior superior pole of attachment of the reciprocal tension membrane, the anterior attachment of the falx cerebri. When the falx pulls on the crista galli, the posterior end of that plate drops down during inhalation and goes up during exhalation. If it were not for that motion there would not be normal function in the mechanism of the olfactory bulbs, which are themselves a mechanism. The meninges of the brain extend over the olfactory bulbs and include the cerebrospinal fluid. When you hear someone sneeze, do not tell him that he is catching cold. He is, instead, protecting his nasal mucosa with cerebrospinal fluid. This service is one of the physiologic functions of the olfactory bulbs.

Although the ethmoid bone belongs to the cranial base, its turbinates function in the face. The turbinates are often in expansion in sinus complaints. In that case the frontoethmoidal articulations might be said to be in expansion as well.

The Orbital and Sinus Regions

Study the parts of the walls of the orbits. Note the articulation of the greater wings of the sphenoid with the zygomatic bones. Here is another mechanism to consider when observing the face. When a little child gets a bump on the zygoma, please correct it. Otherwise it might lead to pathology in the eye. The zygomatic bone is frequently found in malalignment and as it functions in the mechanics of the orbit, injuries to it may well affect the eyes.

Think of the widening and narrowing of the sphenomaxillary fissure. Then think of that other fissure, the sphenoidal fissure, the superior fissure formed by the lesser and the greater wings of the sphenoid. That will also demonstrate a widening and narrowing during inhalation and exhalation. Then think back to what is attached to them: the walls of the cavernous sinuses. A restriction of the flow of venous blood from that vascular organ, the eyeball, could result from a little blow, a small traumatic force upon the zygoma. Some of the most serious conditions of the eye have followed from such events.

Let us look at the cavity in the body of the maxillary bone. This will show more applied anatomy of the face. As the maxillae are formed in membrane, the walls of the maxillary sinuses are an osseous membrane. There are conchae, or turbinates, on the walls of the nose that curl and uncurl. The superior and middle turbinates belong to the ethmoid. The sphenoidal conchae and the inferior conchae are separate bones. The nasal accessory sinus system consists of the cavity in the body of the sphenoid, the frontal sinuses, the ethmoid air cells, the maxillary sinuses, the middle ears, and the mastoid air cells. All are air sinuses, and the mucosa lining them is continuous. It seems that there must be some process for changing the air in this system during inhalation and exhalation, otherwise there would be a stasis of air and the organisms would be free to multiply. What mechanism would accomplish such a process?

Look at the articulation of the zygomatic bone with the maxilla. It sits right on top of the zygomatic process at the apex of the maxillary pyramid. This framework presents an L-shaped area on the zygoma that articulates with another L-shaped area on the maxilla. The zygoma functions as an interosseous mechanical arrangement between the sphenoid and the maxillae and also between the temporal bones and the maxillae.

Look at the vomer. Its walls that form the alae fit right over the rostrum of the sphenoid. From there it extends out over the horizontal plates of the palatines and the maxillae (the roof of the mouth), and forms part of the septum of the nose. During inhalation the zygomatic bones and the vomer function somewhat like a plumber's plunger on the sphenoidal sinus and the maxillary sinuses. This function looks like a mechanism for the interchange of air to me.

The Eyeball

Little things like the origin and insertion of the extrinsic muscles of the eyeball will challenge your skill as an osteopath. One of them originates in the roof of the orbit and another in the floor. The other four originate in a cuff around the optic foramen with attachments between the roots of the lesser wings of the sphenoid and the greater wings of the sphenoid. The optic nerves and the ophthalmic arteries come through this canal into the apex of the orbits. The nerves that supply these four muscles, the third and the sixth cranial nerves, emerge through the superior orbital fissure. The shape of this fissure changes as the relationship between the greater and the lesser wings of the sphenoid changes during inhalation and exhalation.

If the orbit were a cavity with solid osseous walls, where in the name of common sense would you find accommodation for the circulatory physiology of the eyeball, a vascular organ? Look into the cone-shaped space and see the two outstanding fissures — the superior and inferior orbital fissures — and ask if there is not evidence of the provision for mechanical changes resulting from motion.

I remember the day a call came from out in the country that said, "Our boy is down with spinal meningitis." I was told that the family doctor had said that he was not certain of the diagnosis because the patient had no fever. The only thing was that his eyeballs were rolled backward and upward. I was given this history: One of those old-fashioned doors that swing from hinges at the top had come down and hit the boy directly over his forehead. I found that the frontal bone was driven back bilaterally upon the lesser and greater wings of the sphenoid.

The result was mechanical restriction in the area. It was a little thing in this delicate, intricate mechanism that was easily corrected. The eyeballs returned to their normal position and movement. It looks simple and it is if you see clearly what happened when the blow struck. For the correction of the problem I used the technique that I call the "cant hook."[1] When you have grasped the frontal bone in that procedure, be sure to first *lift* the frontal bone *up and off* both the lesser and greater wings of the sphenoid *before* carrying it back where it came from.

The Vasculature

There are many things to think about in the facial mechanism and its relation to the cranial base. Review your knowledge of the anatomy of the region. Note what nerves pass through certain foramina and certain canals. Follow the course of the nerves to the extrinsic muscles of the eyeball and consider the advantage of their passage through the cavernous sinus. Then, note that the carotid artery has walls like all arteries and also a course in the cavernous sinus. Think about the protection of the arterial supply to the brain and the difference in the course of the venous blood on the way out of the cranium.

1 The frontosphenoidal technique using the "cant hook" is detailed in Magoun, *Osteopathy in the Cranial Field*, pp. 170- 171.

It is said that ninety-five percent of the venous blood in the cranium leaves through the jugular foramina. Each jugular foramen is formed by the anatomy and articulation of the petrous portion of the temporal bone with the basilar process of the occiput. Thus you have a foramen that is formed by the articulation of two bones. A luxation here could restrict the venous flow from the entire head. That would include the choroid plexuses. The significance of a foramen formed by the articulation of two bones is profound.

Think about the petrosal sinuses, the superior and the inferior. Think about the relation of these to the cavernous sinuses that are the main venous channels from the eyes. A restriction in that channel, anywhere between the orbits and the jugular foramina, could produce a condition favorable to the development of glaucoma. Consider this point in your next case of glaucoma.

The Oropharynx and Auditory Tube

I was asked the other day about stuttering. In response, I told the doctor about my experience working in a stuttering clinic. They taught an exercise there that required furling of the tongue, and some people were unable to furl their tongue. After I worked with that little palatine bone so as to change the relation between the origin and insertion of the anterior pillar, they had no further trouble with the exercise of furling the tongue.

Beneath the petrous portions of the temporal bone and the sphenoid there is much anatomical detail to think about. The origin of two little muscles, the levator palati and the tensor palati, is on bone. The insertion is in the soft palate, in muscular tissue. From that soft palate there is another muscle, the anterior pillar, running to the tongue. The posterior pillar, which is muscular tissue, runs to the pharynx. Consider what a strain might do to the origin and insertion of those muscles related to the soft palate, the pharynx, and the tonsil.

Consider the anatomy underlying the area of the sphenobasilar junction. Note especially how it would be when the sphenobasilar junction has moved into an extreme position of flexion and both temporal bones are in marked external rotation. See the bunched-up condition, the crowding, of all the soft tissues that are located under the cranial base.

There is also the picture of how the basilar process of the occiput carries the petrous portions of the temporal bones when it is turned on its anteroposterior axis. That is, when it is up on one side and down on the other. Remember that whenever the basilar process of the occiput is tipped up on its side, the petrous portion on that side is always found in internal rotation. The petrous portion on the low side, obviously, will be found in external rotation. Therefore, it is possible to understand the position of the basilar process by the position of the temporal bones. There is no end to the depth of this picture, either from the inside or the outside.

The formation of the cartilaginous portion of the auditory tube occurs at the distal end of the osseous portion. Both the front of the petrous portion of the temporal bone and the back of the greater wing of the sphenoid participate in this formation. Therefore, the relations between the temporal bone and the sphenoid have mechanical significance. The membranous part of the auditory tube is located in the pharyngeal wall and ends in the fossa of Rosenmuller where its mouth is located just above the soft palate.

When the petrous portion of the temporal bone rotates externally, the tube follows and the mouth of the tube opens. Then, you find that it closes when the petrous portion rotates in internal rotation. Realize that the middle ear is an air sinus. When the petrous portion is held abnormally in external rotation and the mouth of the auditory tube is held open, you can hear the roar. You may hear it as well as the patient. Then, when it is turned partially, like a flute, there may be a whistling noise. When the petrous portion is held in internal rotation and the mouth of the auditory tube is held closed, the patient complains of a feeling like cotton stuffed in his ear. Swimmers and divers often bring this complaint to you. You can specialize, as an osteopath, in problems of the eye, ear, nose, and throat by understanding that petrous portion of the temporal bone.

At the meeting of the International Society of Sacro-Iliac Technicians, I was asked to treat a young man who had dived off a board in the dark and landed in water that was not as deep as he expected. He struck something. His main complaint was the feeling of stuffed cotton in his ear. The demonstration that I made before the group was successful. The petrous portion of the temporal bone that was holding the mouth of the auditory tube closed was corrected and the release resulted in the disappearance of the feeling in his ear.

Thinking osteopathy with Dr. Still involves nothing less than a full view and study of the whole body. This includes the origin and insertion of muscles, soft tissues, and fascia, not only the bony tissue. Dr. Still said that he named his thought osteopathy because you start with the bones. When you think of the fascia, think of it from all views: the inside, the outside, both ends of bones, muscles, or any structure. Remember that the art of *knowing* includes not only the fascia but also what comes of drags on the fascia. Can you see that there is crowding of muscle tissue in certain positions of the petrous portions of the temporal bones?

The Facial Nerve

Let me tell you about the facial nerve. Where does it start? Where is its nucleus? What course does it take? Where does it go? Have you ever treated it through the temporal bones? Do you recall its connections with other nerves? You know that it supplies the muscles of facial expression in the face. In cases of

Bell's palsy you understand that the seventh nerve is not doing its job or is sufficiently irritated to cause spasm. Entrapment neuropathy explains either problem. Let us study osteopathy along with Dr. Still and put our attention on the facial nerve.

The facial nerve is efferent from its motor nucleus in the pons. The fibers pass laterally and leave the brain just medial to the acoustic ganglion. From there they continue caudally and are lost in the tissue of the hyoid branchial arch. The sensory fibers of the facial nerve grow from the cells of the geniculate ganglion.

The facial nerve supplies derivatives of the second branchial arch. In mammals these are muscles that move the skin and cartilages of the eyelids, nostrils, mouth, and ear. The stylohyoid, the posterior belly of the digastric, and the stapedius muscles of the middle ear are also supplied by the facial nerve. The nerve is in company with the acoustic nerve at the internal acoustic meatus. Leaving the acoustic nerve it makes a sharp bend backwards in the substance of the temporal bone to enter the facial canal, which curves over the superior and dorsal aspect of the middle ear. It quits the temporal bone at the stylomastoid foramen on its lower surface.

Within the facial canal the facial nerve gives off a tiny branch to the stapedius muscle, which tenses the oval window of the middle ear to adapt for loud sounds. The main trunk curves forward and laterally over the mandible and in the substance of the parotid gland. It breaks up into a number of twigs for the frontalis, the buccinator, and those muscles around the eye, nostril, and mouth. It is liable to injury resulting in Bell's palsy. In that case the corner of the mouth droops, the nasolabial furrow is smoothed out, and the palpebral fissure is widened. Facial spasm is the reciprocal of Bell's palsy and may result from irritation to the facial nerve somewhere on its course. It begins with involuntary winking and spreads to other muscles, expressing itself in rapid twitches.

The Trigeminal Nerve

There is an important ganglion, the trigeminal, lying in a little depression on the front of the apex of the petrous portions of the temporal bones. I call the trigeminal ganglion a "roly-poly" because it is rolled this way and that way as the petrous portion rotates in external and internal rotation during inhalation and exhalation. It belongs to the fifth cranial nerve and is the same as a dorsal root ganglion on a spinal nerve.

The fifth cranial nerve is called the trigeminal because it has three branches. All the branches include sensory nerves for general sensation from the face, scalp, and mucous membranes of the oral and nasal pharynx. The motor nerve that supplies the muscles of mastication joins the mandibular branch as it descends through the foramen ovale. Restriction of internal and external rotation mobility of the petrous portions of the temporal bones results in several problems that appear in the face.

Consider the circumrotation of the sphenoid bone. The promontory does not move forward or backward. The whole is like a suspended wheel. (See Figure 2.) Follow around the wheel and see the various locations on it as spokes. It will help you to visualize the point of lesion in your technique if you think in terms of the location of any part on the wheel. See the different levels of the sella turcica, the ethmoid spine, the lesser wings, the tips of the greater wings, the roots of the pterygoid processes, the rostrum, and the spina angularis on the under surface of the greater wings. Remember that little things are the big things in the science of osteopathy.

One of the little things on that little palatine bone is the orbital surface, a small triangular surface that is smooth. That surface sticks right out at the very back of the floor of the orbit. You begin to wonder why it is there. Then you think back along the maxillary nerve to the trigeminal ganglion. As you follow the middle branch of the fifth cranial nerve straight out through the foramen rotundum in the sphenoid bone you find it passing right around that smooth surface on the orbital process of the palatine bone. It then enters a groove in the maxilla as the infraorbital nerve to emerge on the front of the maxilla through the infraorbital foramen.

Look at the course of this nerve from the apex of the anterior aspect of the petrous portion of the temporal bone to the foramen rotundum, to the orbital process of the palatine bone, into and through the body of the maxilla — four bones lined up in the action, and each moving in its own way. Then look at the inferior orbital fissure, formed by the sphenoid, the palatine, and the maxilla. There is no articulation here, only the space that is changed as the bones move in their course. See that this nerve, coming out of the sphenoid, is crossing the fossa and passing around that little surface on the palatine bone to enter the groove in the maxilla. Then, when we tell you of the mobility in the orbits, a widening and narrowing during inhalation and exhalation, what are you to think of the effect on this nerve?

If it were not for that little arrangement with the orbital process of the palatine bone, there would be a wearing tension on the maxillary nerve. Have you seen the machinery of a threshing machine, how there is a belt running along and a little tension regulator running along the belt? This little orbital process of the palatine bone serves as a tension regulator that prevents the nerve from being worn in two during inhalation and exhalation.

The Palatine Region

Another little thing in the applied anatomy of the face is the little palatine bone. This delicate little bone is an intermediary between the sphenoid and the maxillae. There are two furrows on the back of the vertical part that are peculiarly concave. There is a medial one and a lateral one. The pyramidal process of the palatines fits in between the pterygoid plates of the sphenoid. Its function may be compared to the "frog" in railroad switching yards — that is, the "frog" keeps the rails aligned when there is a switching from one track to another. The mechanics of the action between the convex tips of the pterygoid processes and the concave grooves on the back of the palatine bones is like a shuttle that goes back and forth.

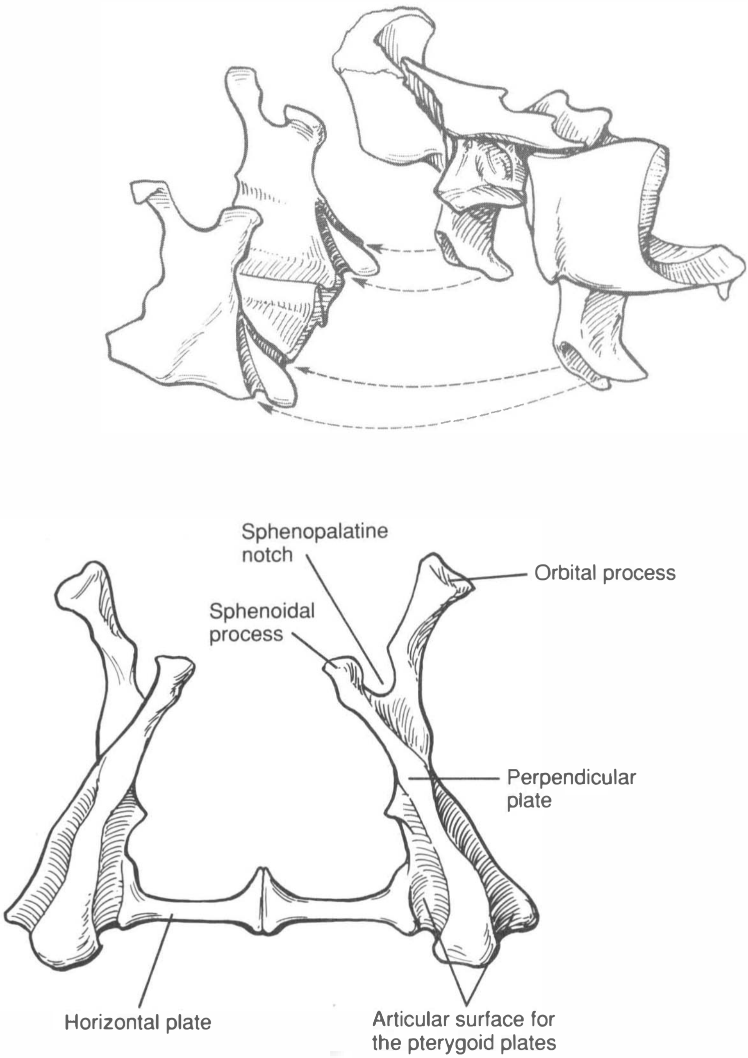

Figure 9. The posterior articular surface of the palatine bones and their relationship to the pterygoid processes, showing the "ruts" on the posterior palatine where the pterygoid plates glide. Note the orbital process of the palatine bone.

The two furrows on the back of the palatine bone are not the entire mechanism. The entire mechanism resembles that of a sewing machine. There is a little shuttle in the mechanics of a sewing machine that runs in a concavity and shuttles back and forth. The pterygoid processes act like shuttles in the concave furrows on the palatine bones. The pterygoid processes, two of them, hang down from the body of the sphenoid. Each has a medial and a lateral plate. The tips of these are smooth and fit into the medial and lateral grooves on the palatine bones. These tips converge anteriorly and diverge posteriorly.

This delicate little shuttling movement between the tips of the pterygoid plates on the sphenoid and the furrows on the palatine bones is one of the big things in the science of osteopathy. It is one of the important mechanical principles that you must understand and include in your knowledge of the cranial mechanism.

Look at the human head as a whole and see that it converges anteriorly and diverges posteriorly. Think of all the little places within it where this design operates as a mechanical principle. From the articular facets on the atlas and the occipital condyles to the greater wings of the sphenoid, from the ethmoid notch in the frontal bone(s) to the mandible, the anterior convergence/posterior divergence is conspicuous. Consider the structural and mechanical advantages of this design in terms of stability and mobility.

* * *

Next, I want you to go with me to the area of that little palatine bone beneath the nasal fossae and in line with the roof of the mouth. On the back of the vertical part you see two little ruts, or grooves, that follow the mechanical principle of converging anteriorly and diverging posteriorly. There are two palatine bones and each has double grooves. Visualize a truck with double tires. If the truck was in a muddy street the two tires on each wheel would form such grooves in their track. If you wanted to back up, the wheels would back up in the ruts. One tire would be in its rut and the other in its own rut. The ruts would be something that the wheels would rotate in.

Look at the tips of the medial and lateral pterygoid processes on the sphenoid. Here is one bone that has two pterygoid processes, and on each there are two plates. These pterygoid processes converge in front and diverge in back. They are like the tires on the wheels of that truck. The palatine mechanism is where the tips of the pterygoid processes move in the ruts on the back of the little palatine bones. That palatine bone articulates with the maxilla on each side of the face.

As the sphenoid bone makes its circumrotation, see these pterygoids as spokes on the sphenoid wheel. As the wheel rotates to a different level, they do the same thing to those little palatine bones that the greater wings do to the ethmoid and frontal bone(s): the movement of the sphenoid spreads them. As the pterygoid processes ride in the ruts on the palatine bones, they turn them outward into external rotation. The palatine bones, in turn, turn the maxillae, which hang from the nasal notch of the frontal bone(s), into external rotation.

Then, as the sphenoid circumrotates into its extension position, the pterygoid processes are backing up in the ruts of the palatines and draw the palatine bones and the maxillae into internal rotation. Do you see the picture? Do you see the mechanism? It is a mechanism that is subject to mechanical strain frequently. If you disturb the mechanism at the bottom of the palatines, you are going to disturb the mechanism at the top. The other relations there become affected and the physiologic functioning of the sphenopalatine ganglion is most apt to be disturbed. The place where the disturbance is most probable is where the maxillary nerve goes around the little orbital process of the palatine bone at the back of the floor of the orbit. This is the picture when you tackle some of the mechanical strains in the mechanism of the facial bones.

I have made the statement that if you did nothing more than diagnose and treat appropriately the problems of the palatine bones you could establish a successful specialty practice. Do you see why? You, as a mechanic in the art of knowing the mechanism and of applying the technical work through the rule of the artery and nutrition, would be influencing the sphenopalatine ganglion.

Most infections get into the system by passing through the material breathing apparatus. That includes the throat, the larynx, and so forth. What is fastened to these little palatine bones but what we call the soft palate, a muscular tissue? From that we have muscular tissue running to the pillars that surround the tonsil, that little mischief maker that may be full of infection.

There is the anterior pillar running to the tongue and the posterior pillar running to the pharynx — muscular tissue. Entering the same soft palate are the levators and tensors of the palate, muscles which have their origin back on and beneath the cartilaginous portions of the auditory tubes. That is, on and beneath the petrous portions of the temporal bones and the greater wings of the sphenoid. You understand that you can distort the origins and insertions of muscles. That particular problem occurs with fracture of the arm, for instance. What does it mean to the functioning of this mechanism to have a distortion of the origins and insertions of related muscles?

Consider the situation in tonsillitis when infection has settled there. This may be the case in influenza, the beginning of pneumonia, or any acute respiratory infection when the little "bugs" are multiplying. See the mechanical principle in the location of that tonsil, lying between those pillars, that muscular tissue. Then is the time to apply your art of *knowing* to that little palatine bone and see how the mechanism can arrest the process and eliminate those little "bugs" in the area. I want you to try it out. I am speaking from experience. It is not an idle statement.

The Sphenopalatine Ganglion

The middle branch of the trigeminal nerve, the maxillary nerve, leaves the interior of the cranium through the foramen rotundum. It emerges to cross the top of the pterygopalatine

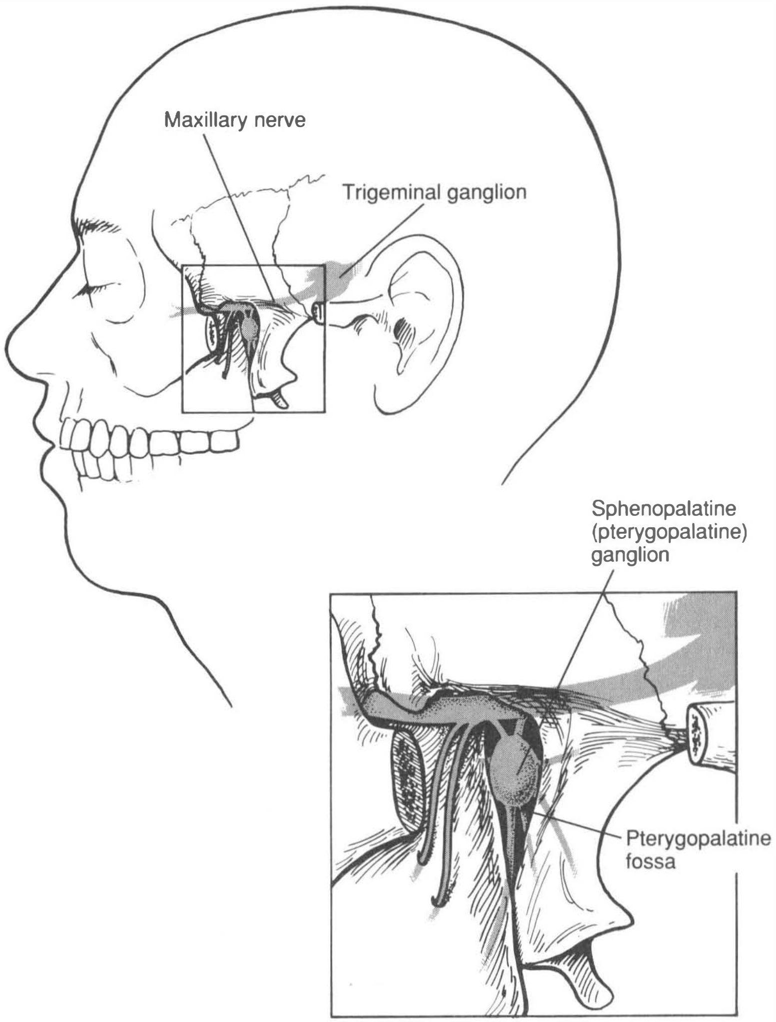

Figure 10A. Lateral view of the sphenopalatine (pterygopalatine) ganglion, showing it suspended from the maxillary nerve within the pterygopalatine fossa.

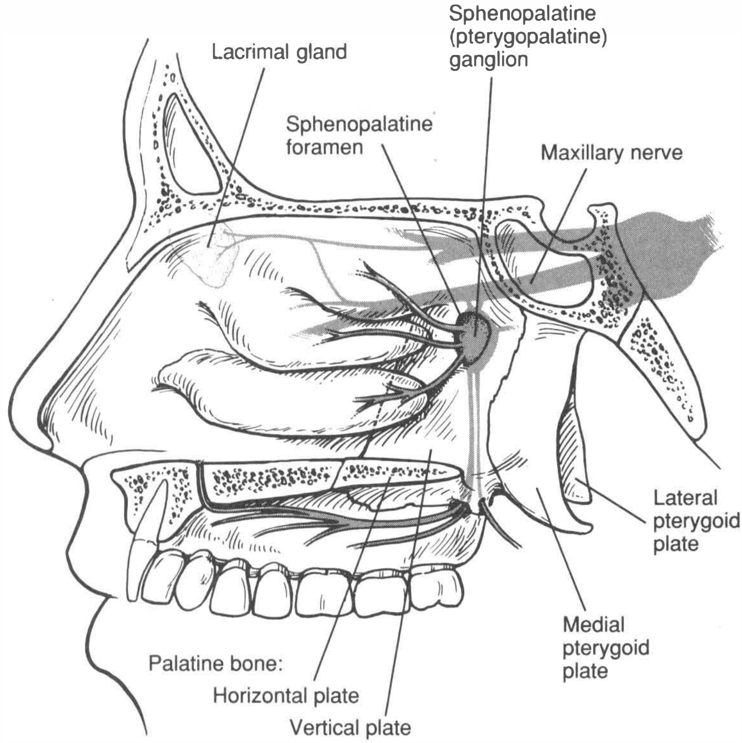

Figure 10B. Medial view of the sphenopalatine (pterygopalatine) ganglion, showing its relation to the bony landmarks and its innervation of structures in the oral and nasal pharynx. Note the branch that ascends to contribute innervation to the lacrimal gland.

fossa. As it passes across, two roots drop to suspend the sphenopalatine ganglion in the fossa. It then runs around the orbital process of the palatine bone at the back of the floor of the orbit to enter the infraorbital sulcus and becomes the infraorbital nerve.

The two roots that suspend the sphenopalatine ganglion in the pterygopalatine fossa hang like those that suspend the big lights at street crossings for the control of traffic. Like the traffic light, the ganglion swings back and forth in its space. It sends branches to the mucosa that lines the entire upper respiratory system, including the mouth of the auditory tubes, the tonsils, and elsewhere.

Suppose you get a blow over the frontal bone(s) or on the zygomatic bones: see how that blow drives that little palatine bone back onto the sphenopalatine ganglion and affects it in the same way that contact on the ganglion of impar, the coccygeal ganglion, stimulates functions. Try a little experiment on yourself. Place an index finger inside your cheek and move it around the body of the maxilla so as to contact the lateral pterygoid plate. Then tip your head down over the tip of your finger. This brings your contact close to the root of the pterygoid process. Let your head rest there while your breathing produces movement. Note the prompt response to the stimulation from the lacrimal glands particularly. I call this copious supply of tears "onion tears" because they are a response to an irritant.

This experimental response to a mechanical stimulation demonstrates the effect caused by trauma to the sphenopalatine ganglion. It is also an effect that is available for clinical use. Realize that the cranial concept is not a specialty. It is working in the science of osteopathy for the benefit of your patients. If you master the mechanical problems in the facial mechanism, you can do wonderful work.

Malalignments of the maxillae can be considered as etiological factors in nasal, postnasal, and pharyngeal affections. The frontal process may be twisted so as to crowd the superior and middle turbinates of the ethmoid as well as the inferior turbinates. The malposition narrows the sphenomaxillary fissure in the orbital cavity and in extreme situations may crowd the palatine bone and disturb the function of the sphenopalatine ganglion.

The palatine bones are usually involved in injuries to the maxillae. Also, as they form part of the articular portions of the orbits, they need to be considered in eye complaints.

* * *

The sphenopalatine ganglion is one of the little things in the facial mechanism. Lying between the little palatine bone and the body of the sphenoid, it hangs, like one of those traffic lights at a street intersection, from two wires. You see it swinging back and forth in the pterygopalatine fossa. Compare this swinging, the rocking of the olfactory bulbs, and the roly-poly movement of the trigeminal ganglion. Do you see the difference of movement? Think of the depth of what all these little things indicate: motility.

That is the point I would like to bring out. Everything is in motion. The cribriform plate of the ethmoid rocks the olfactory bulbs, the rotation of the petrous portions of the temporal bones rolls the trigeminal ganglia, and the relation between the sphenoid and the palatines allows the sphenopalatine ganglia to swing. These ganglia are relay stations on the great petrosal nerves. They connect up with vasomotor roots, sensory roots, and most important, supply nutrition to the mucosa of the upper respiratory tract.

You can make a contact that influences the sphenopalatine ganglion.[2] You can get a finger close to the root of the pterygoid plates and ask the patient to drop his head upon your finger. The efficacy of the influence is demonstrated by a flow of tears from the lacrimal gland. The lacrimal gland secretes one of the best antiseptics, or eyewashes, for the eyes and also nutrition. The copious flow is almost as much as the flow that accompanies the peeling of onions. That is why I call this response "onion tears."

Visualize what is going on when you get this response. Branches from the ganglion run out to the nasal turbinates and down to the pharynx. The magnitude of the influence of that

2 Dr. Sutherland compares the contact that can be made on the sphenopalatine ganglion with "the contact you can make on the ganglion of impar that changes circulation in the head."

little sphenopalatine ganglion keeps growing on you as you think of *applied physiology*, the subject that Dr. Still insisted upon.

Consider the situation when the maxilla is in malposition, pushing back on that little palatine bone and reducing the space in which the little ganglion is located. Such pressure can do something more emphatic than the little light pressure beyond your finger, which does not actually touch it. Such pressure can change its normal physiologic functioning.

Look from another angle and visualize the body of the sphenoid. There could be a malposition with crowding forward onto the fossa within which this little ganglion lies. The influences and possibilities related to that sphenopalatine ganglion continue to grow as you study this mechanism. Applied physiology has been a living part of my professional life. The depth of these little things as seen in the science of osteopathy leads to a view of possibilities as great as the magnitude of the heavens.

Considerations in Treatment

Treating the Palatines

The art of applying that technique to the sphenopalatine ganglion is like the art of the watchmaker in dealing with a small lady's watch as compared with the skills of a mechanic who repairs automobiles. It is a little thing to be handled with delicacy, not a determined thrust. In the art of knowing your mechanism you use the application of that light gentle contact that you see when a bird lights on a twig without injuring the bark. Then you allow natural forces to make a reduction. Do you see? How many in the osteopathic profession know that?

Why did I call your attention to the divergence of those little ruts that articulate with the tips of the pterygoid processes, which also diverge posteriorly and converge anteriorly? You, as the watchmaker, must take this mechanical principle into consideration. If you took the track in which a truck is running and turned it at either end, you would have trouble in getting through that rut. That is the principle. See the mechanical situation when this rut is turned, either in external rotation or internal rotation. See the interference with the movement of the pterygoids, or the truck tires that should ride in the ruts.

Next, you must understand how to get that palatine bone turned in the right direction so as to conform to the pterygoids. Remember that they diverge posteriorly. So your effort must be to turn the posterior edge of the palatine bone laterally in order to conform with the divergence of the pterygoid processes. Do you get the point? If you turned the palatine medially you would be turning it in the wrong direction. You would lock the movement of the pterygoid in the rut, and that would lock the movement of the sphenoid.

I want you to apply the art, the *osteopathic art*, of solving the problem with this little palatine bone in relation to the pterygoid process of the sphenoid. I want you to think and practice until you have mastered the art of solving the mechanical problems of the palatine bones. It will save you a lot of work and benefit your patients. The first thing you know, patients will be seeking you from near and far.

I am going to direct you in what I consider the proper technique for reduction of malposition of the palatine bone:

- First, take a skull and look at the bottom to visualize the junction of the palatine with the maxilla and with the tips of the pterygoid process of the sphenoid. (See Figure 11.)
- Second, study the palatine bone on each side to note the thin curve of the posterior surface of the horizontal plate. What you cannot see or feel is right behind that thin part. This is where the double ruts go, diverging posteriorly out in the lateral direction. That is the same direction in which the pterygoid processes go.
- Third, you need a gentle technique that is able to turn the palatine bone laterally. Not backward, nor forward, nor

upward, but laterally. That is so that the runner and the groove in the rut will conform, so that the furrow on the back of the palatine will conform to the tip of the pterygoid process that runs back and forth in it, like a shuttle.

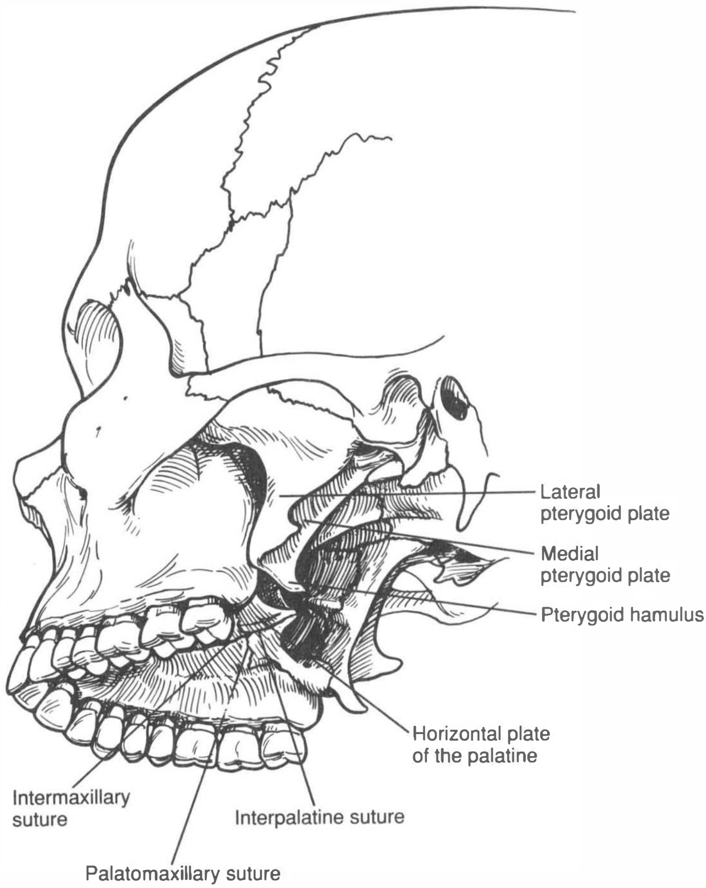

Figure 11. A view of the skull, showing the palatomaxillary suture. Note the location of the hamulus on the medial pterygoid plate.

As you turn the palatine laterally, you are turning it in the same direction that the pterygoid hangs. The sphenoid is one bone. The palatine is a separate bone, one on each side. So you turn the groove, not the pterygoid, in order to have a smooth articulation. How are you going to do that?

When you look at the undersurface of the skull at the back of the choanae you see something hanging down. That is the hamulus on the medial plate of the pterygoid process. Be careful. Do not go in there. There was an instance when someone broke it off. It is a guide, however. You do not look into the mouth. Take your index finger, when you are standing on the same side of the patient as you are working, and run it right along on the undersurface of the upper teeth until your finger strikes the hamulus, the guide that you have gone far enough.

Patients usually do not mind your contact on the under surface of the teeth. All you have to do next is to turn your finger on that fulcrum of the teeth and drop the tip into the free border of the horizontal plate, into the curve. It is a convenient contact for the distal tip of your finger. The soft palate is attached to that curve. As you have dropped into it you have folded up the soft tissue so that you are a little on top of the arch. Now, you turn your finger over using the fulcrum to reach that arch. All that remains to do is to turn your finger so that it turns the palatine bone laterally.

If you understand your mechanism you do not have to look into the mouth since you know where you are and what you aim to do. As you pass your index finger along on the teeth the proximal part of your finger rests on the teeth to serve as a fulcrum. If the patient has no teeth you can run right along the gums.

Use the fulcrum created by your index finger balanced on the teeth. As you turn your finger on the fulcrum, drop it over into that arch on the back edge of the palate. You can feel the arch. You can also feel the strain in the sinuses and the change that has come from that kind of strain. Then all you have to do is turn your finger. Do not push anything, don't thrust anything — it is not scientific. Just turn your finger gently, and you will know when the bone is turning laterally. You will also know when and if you have turned your finger in the wrong direction. You are experienced technicians in this art, and you will know how to turn that bone laterally by turning your finger. It does not matter whether the lesion is in internal rotation or external rotation; you will have to turn the bone laterally to conform with the posterior divergence of the pterygoid process. That is the point. You can use respiratory cooperation or the Tide. Be simple, gentle, and expeditious. Use the frontal bone(s) to turn the sphenoid into flexion with your other hand at the same time.

When you use this procedure clinically and find out what a help it is in the total plan of your operations, you will have a reliable method for solving promptly the problems involving the relations of the palatine bones. In any of your cranial lesions there is no change in the factor of anterior convergence/posterior divergence. The palatine bone is subject to distortions and misplacements. The hidden problem that needs help requires realignment and adjustment. When you are turning the greater wings with contact on the frontal bone(s) you can feel the movement or the lack of movement of the pterygoid processes in the furrows on the back of the palatine bones. You can know when you have the right position.

Examine and study whether the beginning of a problem with the palatine bone may not have been a problem with the maxilla. Then consider the zygomatic bone in relation to the maxilla. Visualize the mechanism between the zygomatic and the maxilla that aerates the maxillary sinus. Recall that an L-shaped area on each constitutes the articular function. Have you noticed how many L-shaped areas enter into these several mechanisms? Not only in the face, but also in the sacroiliac joints.

Treating the Vomer

Thinking of the pumping action of the zygomatic on the maxillary sinus brings to mind the relation of the vomer to the sphenoid sinus. The vomer is shaped somewhat like a plowshare. It is thin, but it has two layers, and they spread to form alae that fit smoothly over the rostrum of the sphenoid. This connection is under the body of the sphenoid that holds the sphenoidal sinus, an air sinus that must have movement for the interchange of air, otherwise, there would be a stasis of air. See that the vomer is another plunger on the center line of the two chambers in the body of the sphenoid, drawing air in and forcing it out.

Now, see the turbinates on the side of the nose as they are in the living body, curling and uncurling during inhalation and exhalation. Understand their function of warming and moistening the air before it goes to the lungs. Consider the mechanical action of the frontal bone(s) in its relation to the ethmoid. Realize the conditions that occur during inhalation and exhalation.

Then, begin to think of the various problems that your patients bring to you. The problems involve congestion in the nasal accessory sinus system with excess secretions, inflammation, stasis, and polyps. Think of the physiologic action of the sphenoid in relation to the whole facial mechanism. What would a malposition of the sphenoid mean to the facial physiology? Look at the nasal septum and think about deviations and bulges of the perpendicular plate of the ethmoid and vomer. If the "wagon-tongue" is forming a bulge, why not change the "wagon" and see how the "tongue" moves back into line?

There is a treatment for the palatines and the vomer that I call the "wagon-tongue." This is illustrated by the picture of a wagon with wheels and a tongue. If you get a wooden horse and put it under the tongue you have a fulcrum. Then, you get on the end of the tongue, and up go the wheels of the wagon. Let us call the pterygoid processes the wheels, the vomer the tongue, and the finger of the operator the wooden horse, or fulcrum.

Place a finger on the roof of the mouth at the cruciate suture. Ask the patient to gently drop his head down upon your finger. When he does, the fulcrum operates to lift the pterygoids upward into their extension position. (See Figure 5.) You can instruct the patient to do that for himself. You can also get out at the end of the "wagon-tongue," in the roof of the mouth anteriorly and gently lift so as to effect an action at the other end.

While we are thinking in this area, visualize something else. If the sphenoid moves in exhalation so as to draw the angles of the frontal bone(s) inward, the metopic suture is coming forward. At the same time, the orbital cavities are narrowing and becoming elongated. This changes their shape toward that characteristic of nearsightedness. The ethmoid notch is narrowed at this time, and the perpendicular plate of the ethmoid is rising along with the ethmoid spine of the sphenoid. Now, as that narrowing goes on, what are the turbinates doing? What are the olfactory bulbs doing? What is going on with all of the air sinuses? When you have visualized all of this you can see what you can teach your patients to do for themselves. You will be surprised to learn all that these simple techniques can offer your patients.

EIGHT

"Bent Twigs:" Compression of the Condylar Parts of the Occiput

THE SUBJECT OF "BENT TWIGS" arises from Dr. Still's phrase "the hole in the tree."[1] I suppose the foramen magnum to be that "hole in the tree," and the reference is to the fact that the occiput is in four parts at birth — namely, the two lateral or condylar parts, the squama, and the basilar process. These parts are located around the foramen and contribute directly to the shape of the "hole." At birth the sphenoid is in three parts — the body and the two greater wing-pterygoid units. The temporal bones are also in three parts at birth. These parts are the petromastoid, the squama, and the tympanic ring.

The living human head is a remarkable structure at birth, when you come to think about it. At this age it is easy to see it as a soft-shelled egg, or a modified sphere, while later in life it is harder to visualize it as such. All these parts of bones are held together by the dura mater, "mother dura," functioning as an interosseous membrane. Because of this the newborn head can hold together and adapt so as to allow a safe passage through the birth canal. Think of it!

1 Dr. Still considered that part of the science of osteopathy which he presented as simply a partial view. He put forth those concepts that people of his day were most likely to apprehend. He emphasized that the science of osteopathy had not been fully delivered, and likened it to a squirrel partially seen within a hole in the tree.

The articulation between the condyles of the occiput and the facets of the atlas is the one established joint at birth. Otherwise, there are no articular surfaces because there are no joints with "gears" at birth. In fact, the different parts of the individual bones of the cranial base grow until the bones are ossified and their parts fused. As part of the growth process, the different bones meet, with the result that joints form gradually and articular surfaces begin to develop. The formation of articular gears for articular movement between the bones, at the sutures, of the human cranium becomes more established around the seventh to ninth years of life, or even later.

These facts require an analysis of the conditions that exist in the skeletal system, especially in the head, during infancy and early childhood. The mechanism that is operated by the dura mater is like the illustration of the two telephone poles with wire stretched from pole to pole. When a sleet storm occurs, the wires become loaded with sleet so that the poles may lean out of the vertical yet remain connected so that they lean at the same angle.

I want you to see that picture applied to the infant cranium when external forces influence its shape. Consider some trauma, either from adaptation to the birth canal or from falls later on in life. Visualize a pull on "mother dura" that pulls the bones out of their normal position or relations. It is necessary to utilize the membranes in order to bring these little bones back to their normal. The membranes would function like the wires between the poles in recovering the normal alignment.

Even following a normal delivery, there is a situation that calls for attention. The baby's head has adapted mechanically to the passageway during birth. When the baby cries and inhales air, aided by atmospheric pressure, the cry is usually vigorous, a special cry, with or without a spank on the sacrum. The process fluctuates the cerebrospinal fluid. Then the membranes go to work and pull the bones into position.

The characteristics of the occipitoatlantal joints enter into this process in an important way. The facets of the atlas are concave. They converge anteriorly and diverge posteriorly. They also converge inferiorly and diverge superiorly. The transverse ligament of the atlas keeps them so. The little condyles on the under surface of the condylar parts of the occiput are convex and fit into the facets of the atlas. The condyles also converge anteriorly and diverge posteriorly, converge inferiorly and diverge superiorly. Remember that these articulations between the condyles of the occiput and the facets of the atlas are the only established joints in the cranium at this period of life.

> Superficially resembling bicondylar joints are those that possess two separate articular cavities functionally behaving as one. The atlanto-occipital joints, for example, are paired but are best regarded as constituting a single ovoid joint with a large central deficiency in its articular surfaces."[2]

The concave facets of the atlas receive the condyles of the occiput. These joints, on each side, extend forward onto the basilar process of the occiput from the anterior end of the condylar parts. The squama of the occiput abuts the posterior ends of the condylar parts. These occipitoatlantal joints are ligamentous articular mechanisms.

Editor's Note: The following information was presented at the course by Howard A. Lippincott, D.O.[3] Dr. Sutherland described this lecture as providing ". . . information that goes with understanding some of the problems that may be found in this mechanism under various conditions."

> This meeting between the anterior ends of the condyles and the posterior end of the basilar process is not a transverse articulation. The joint on the basilar process faces laterally; the one on the condyles faces medially. In many cases the union here is

2 C. H. Barnett, D. V. Davies, and M. A. MacConaill, *Synovial Joints: Their Structure and Mechanics* (Springfield, IL: Charles C. Thomas, 1961), p. 170.
3 (1893-1983) American School of Osteopathy, 1916.

almost in the sagittal plane. The basilar part is fairly well formed at birth; it is ossified, but there is cartilage between the three parts. When the lateral parts come together, forced together by the convergence of the pits of the atlas, the condyles are going to squeeze in against the intervening cartilage between the basilar process and the condylar parts. They tend to slide together. As the pits of the atlas do not yield because of the transverse atlantal ligament, a degree of compression results.

Distortions of the foramen magnum frequently appear as a narrowing of the anterior part. Sometimes the distortion is minimal; at other times the contours show variations with considerable warp. These are directly influenced by the position taken by the basilar process when it was squeezed. There are rare occasions of developmental anomalies and deficiencies in this region. Except for these there is hardly anything that can make the condyles diverge when they have been compressed into the convergence of the atlas.

Compression or angulation can also occur at the posterior end of the condylar parts, at the condylosquamal junction. The shape of the squama of the occiput is circular with the inion at the center. The landmark at the center of the posterior rim of the foramen magnum is located at the end of a radius from the inion. It is named the opisthion. The squama may turn clockwise or counterclockwise around the inion. That action carries the opisthion to the right or left. This information should be part of a structural examination.

Depending upon how the squama has turned, the pressure on the posterior end of the condylar parts can be analyzed. There is anteroposterior pressure on one side and mediolateral pressure on the other. The condylosquamal junction may also be angulated in relation to the condylar parts. That is, the angle between the squama and the condylar parts may be more acute or more obtuse than the usual normal curvature.

The various conditions that may arise in the relations between the four parts of the occiput are sufficient to account for the various shapes of the foramen magnum. Should these

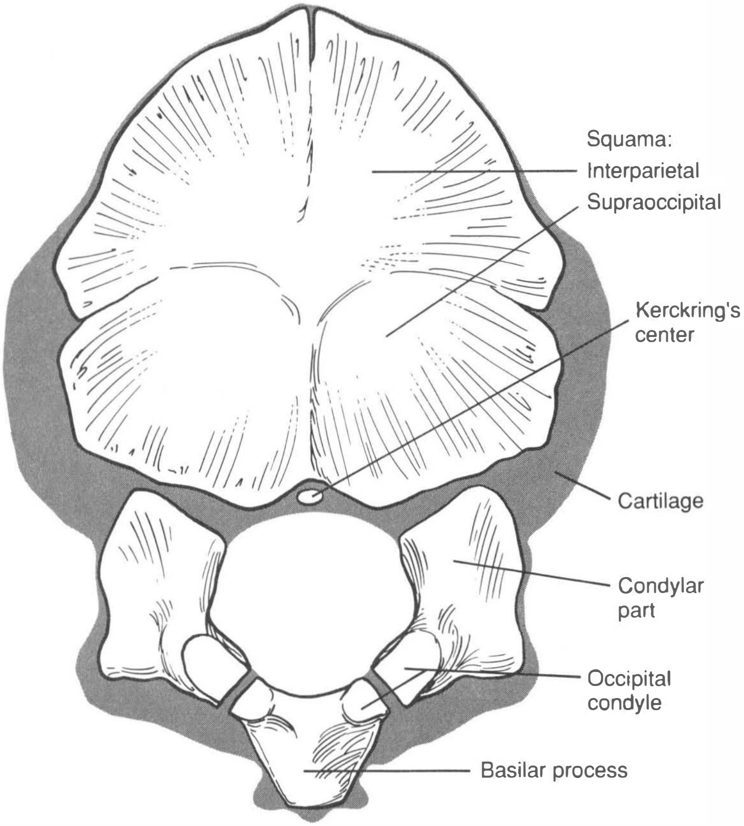

Figure 12. The occiput at birth, showing it to be in four parts within a cartilaginous matrix. Note that the articular condyles receive contributions from both the condylar and basilar parts of the occiput.

distortions persist during growth in infancy and childhood, they manifest the principle described by the saying, "as the twig is bent so is the tree inclined."

There is great importance, therefore, in examining newborn babies with care and precision. At that time it is easy to assist the powers in the primary respiratory mechanism, already in action, so as to establish normal positions and relations among the cranial bones, especially among the four parts of the occiput.

The techniques that you can use for resolving problems created by such distortions of the infant cranium as Dr. Lippincott has described are many. However, they all depend upon a correct understanding of the mechanism, especially the reciprocal tension membrane, for that is what moves the bones.

I have called attention to the similarity of the tentorium cerebelli to the falx cerebri, pointing out the three sickles that move around a fulcrum. That is what you will utilize in reducing compression of these condylar parts before the "gears" are formed. It is also utilized as one of the agencies in reducing compression in the adult skull.

I want you to see that if you put a little tension on the frontal bone(s) in a certain direction on one side — say on the right — there will be action at the back on the squama of the occiput that will swing it around on the left so that the anterior end of the condylar portion moves out. It is useful to study the picture of the membranes in an anatomical specimen of an infant skull. You can see the posterior pole of attachment of the reciprocal tension membrane is located on the inside of the occipital squama. The use of the membranes in conjunction with the fluctuation of the cerebrospinal fluid provides a way for decompression and moving these parts away from the basilar process so that it can assume its normal place and relations.

When the condyles have been driven downward or anteriorly into the pits of the atlas, the relation between the condyles and the atlas have been disturbed. An occipitoatlantal ligamentous articular strain has been produced. It is first necessary to correct this lesion. The ligaments are used to make the correction.

Because it is not possible to make a manual contact with the atlas, the procedure for doing this aims to bring the atlas to the operator. The operator slips his middle finger down along the occiput from the inion towards opisthion. The patient's head is thus cradled in the operator's hand and the operator's hand remains still with the tip of the middle finger simply down near the rim of the foramen magnum.

The patient who is able cooperates by nodding his head without flexing his neck. As he nods, the opisthion moves back and the posterior tubercle on the posterior arch of the atlas comes to meet the operator's finger. This stabilizes the atlas and allows the occipital condyles to move into the divergences of the atlas, thus releasing the strain. The occipitoatlantal ligaments rebalance the joint mechanism. The operator can then proceed with the technique for decompressing the condylar parts according to the diagnosis. This operation for the occipitoatlantal mechanism can be repeated if necessary, for another rebalancing following the rest of the treatment.

Editor's Note: In the case of the newborn or infant who cannot cooperate by nodding, the operator may tip their head slightly forward using a gentle contact on the frontal region.

It is useful to have a mental picture of the area where the condyles of the occiput meet the posterior end of the basilar process because it is not possible to know directly how the basilar process has responded to the compression. A small part of the joint is actually on the basilar process and included in its synovial membrane. (See Figure 12.) There is no way of knowing how the compressive forces have been distributed; therefore, the goal of any technique is simply a carrying away of the parts. In the infant head the posterior ends of the condylar parts are accessible to the operator.

When the anterior ends of both condylar parts of the occiput are symmetrically compressed on the posterior ends of the basilar process, it is possible to decompress bilaterally. That may happen with the correction of the occipitoatlantal strain, but it may be easier to address one side at a time.

Contact one side and hold it steady. Then, with your contact on the other side, turn it away while directing the Tide from the opposite side of the vault. This is a delicate operation guided by the operator's sense, from his contact, of tension at the other end of the condylar part. This can be repeated on the other side if indicated. Respiratory cooperation from the patient is often precisely provided by lusty crying. A rebalancing of the occipitoatlantal mechanism should follow.

The principle of the "bent twig" manifests most clearly in the adult. Such distortion of the foramen magnum as may have occurred in infancy or childhood is magnified by growth and perhaps complicated by falls or other injuries along the way.

This problem in an adult patient often indicates the need for a solution. The procedure for decompression is the same except that the cooperation is postural as well as respiratory. Dorsiflexion of both feet for bilateral or midline effect is a good way to stabilize the field of operation. When working on a unilateral problem, ask the patient to dorsiflex the diagonally opposite foot. Build up the tension in your contact gradually and release it gradually. It is even more important to rebalance the atlas after the treatment of adults than of infants.

The management of distortions between the squama and the posterior ends of the condylar parts of the occiput follows the same general principles of using the dural membranes, the Tide, respiratory cooperation, and postural cooperation from the patient. Precise manual design for each step of the way is necessary for successful manual operations. Many of the distortions in the relations of the parts of the bones of the cranial base at birth have been recognized in medical literature. However, the full implications for the future of a child have not been appreciated and neither have procedures for restoring normal relations been developed or described. The basic understanding of the problems lies in the science of osteopathy.

Mothers are often distressed by the shape of their baby's head immediately after birth. They are often reassured by nurses and doctors with remarks to the effect that distortions will change within a few days. It often happens that they do change toward the normal shape that parents like to see. It is instructive to consider what is at work in accomplishing such a change.

The baby's crying and suckling function in many ways to realign the bones and the parts of bones. Then there is the regular breathing that contributes to the fluctuation of the cerebrospinal fluid. The hydraulic lift that the cerebrospinal fluid gives in the infant head from within is smooth and powerful. Its service is enhanced by the baby's crying. The problems that are prevented by these natural processes are understood only when conditions limit their effectiveness.

Editor's Note: The remaining text of this chapter is adapted from Dr. Sutherland's writings in *Contributions of Thought*.[4]

Often, through trauma over the top of the head or at the back of the head, prenatally, postnatally, and sometimes during normal passage of the baby through the birth canal, adaptations occur. In the normal passage with the usual mechanics of delivery, the parietal bones mold over the frontal bone(s), the parietal bones mold over the interparietal occiput, and the head as a whole molds so that it can pass normally through the maternal pelvis. After passage the adaptations may neglect to return to normal positions.

Other Intraosseous Relations

In addition to intermembranous and intercartilaginous unions during the prenatal and childhood periods, the occiput and sphenoid possess intraosseous epiphyseal units that I consider vitally important in the study of the cranial concept. These intraosseous epiphyseal units are subject to frequent luxation and are likely to become predisposing factors leading to grave disturbance throughout the central nervous system when they do not have skillful and intelligent reduction.

There are two intraosseous unions or connections in the sphenoid: one between the superior area of the body and the

4 "Bent Twigs — Infants and Children," pp. 144-146 and "The Hole in the Tree," pp. 228-232.

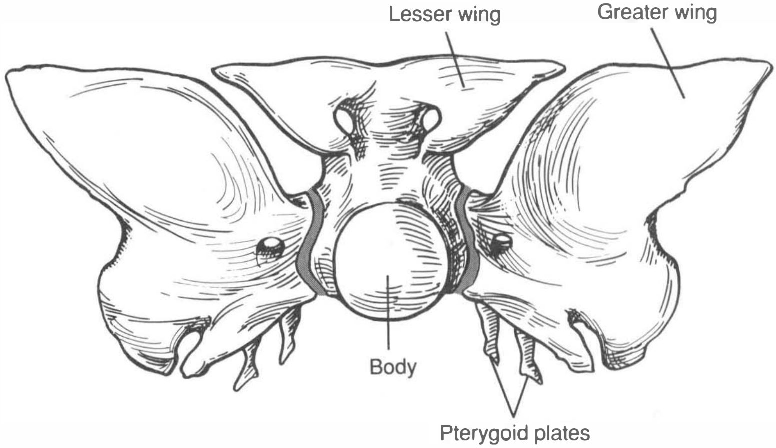

Figure 13. The sphenoid at birth, showing it to be in three parts. There is intervening cartilage between the body-lesser wing unit and the greater wing-pterygoid units.

lesser wings, and the other between the body and the greater wing-pterygoid units. When the lesser wing union allows a shifting of the lesser wings in relation to the orbital plates of the frontal bone(s), the "bent twig" effect may influence the appearance of the eyes or result in malalignments in the walls of the orbits that are common to strabismus. In the various types of strabismus the cranial diagnostician considers the origins of the extrinsic muscles of the eyeball, around the optic foramen and on the floor and roof of the orbits. The mechanical factors in the structure of the orbits, as they relate to the muscles of the eyeball, should be considered in conjunction with other aspects of the problems related to strabismus.

During prenatal and early childhood periods, the intraosseous union between the lower area of the sphenoid body and the greater wing-pterygoid units is said to be a gomphosis, or tooth-and-socket mechanical connection. This connection is later surrounded by an osseous formation that leaves the pintle-oval arrangement as a mechanical accommodation feature for normal rotative movement of the unit in relation to the body. This union is also subject to shifting through traumatic, especially compressive, forces. If this has occurred, look to effects on the palatine bones and irritation of the sphenopalatine ganglion. Compressive forces affecting the intraosseous unions in the sphenoid seriously affect the sphenoidal, maxillary, and ethmoidal sinuses, and the auditory tubes.

The temporal bone presents problems of an intraosseous nature stemming from situations at or before birth and in childhood growth. These may explain developmental anomalies of the ears associated with congenital deafness and susceptibility to otitis media. Abnormal twists in the petrous portions may result in pathology in the inner ear. The temporal bones need to be included in our study of traumatic and compressive forces upon intraosseous parts.

The cranial vault is subject to various distortions in accommodation to the distortions or deformations of the cranial base. Anomalies, deficiencies, injuries, and mechanical strains in the sacrum and innominate bones may present problems as an infant sits, stands, and walks about. Intraosseous luxations and epiphyseal distortions may produce functional imbalances. Thus it is that events that are tolerated when small result in major problems after they become bigger with growth.

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NINE

Membranous Articular Strains

Editor's Note: Dr. Sutherland expressed his understanding of the strains that may occur in membranous articular mechanisms and ligamentous articular mechanisms in several places. This chapter consists, in part, of excerpts adapted from his written work.[1] This is because the teaching of this subject was mainly done by other faculty members at the courses that form the basis of this book.

THE PROGRAM ANNOUNCEMENT OF Dr. Sutherland's lectures at the convention of the American Osteopathic Association meeting in Detroit, Michigan in 1932 read as follows:

> Dr. W. G. Sutherland describes the anatomy and physiology underlying the principle of joint lesions in the cranium which he says closely resemble osteopathic lesions elsewhere and are equally amenable to treatment.[2]

In describing spinal lesions, I prefer the term *ligamentous articular strains*; for lesions in the cranium, *membranous articular strains*. The spinal lesion includes the ligaments as well as the joints. The cranial lesion includes the intracranial membranes as well as the articulations.

The ligaments in their tension regulate the movement in the spinal articulations, as check agents to voluntary muscular

1 Sutherland, *Contributions of Thought* and *The Cranial Bowl*.
2 Sutherland, *Contributions of Thought*, pg. 47.

action. They might be called *reciprocal tension ligaments*. The cranial articulations are involuntary in their mobility and have no muscular agency for operation. They possess a special intracranial membranous tissue, however, that acts not only as an intermediate agency, but functions also as a reciprocal tension agent that limits the normal range of articular mobility.

This tension tissue agent functions somewhat like the balance wheel of a watch, regulating or limiting the to-and-fro movement of the mechanism. Hence, the term *reciprocal tension membrane* is chosen for the function of the intracranial membranes in the human cranium together with the spinal dura mater.

Attention is called to the specific poles of attachment of the falx cerebri and the tentorium cerebelli. (See Figure 4.) In my schematic description there is an anterior superior pole of attachment upon the crista galli of the ethmoid bone, and an anterior inferior pole of attachment upon the clinoid processes of the body of the sphenoid bone. The lateral poles of attachment are upon the superior borders of the petrous portions of the temporal bones. The posterior pole of attachment is upon the inside of the occipital squama.

During the period of inhalation these poles of attachment move in a certain way. During the period of exhalation a reverse movement occurs at the various poles of attachment. This is the normal excursion of the to-and-fro movement in the cranial membranous articular mechanism. It is an anatomicophysiologic mechanism going on throughout life.

In the living skull, normal mobility occurs throughout the articulations of the basilar area and in the facial bones. This mobility is compensated for by accommodation in the articulative service provided in the vault sutures through their serrated, or dovetail, arrangement. These sutures do not completely ossify while life remains.

The falx cerebri and tentorium cerebelli lack elastic and muscular fibers. They are tough fibrous connective tissue. They are taut and tense. They form a balance that moves alternately forward and backward between the various articular poles. In their reciprocating action we recognize a rhythm that is an important characteristic of life's material manifestation.

The dural membrane of the cranium is that part of the total mechanism that serves the same purpose as the ligaments in ligamentous articular mechanisms. The membranes and the ligaments move bones at joints.

Osteopathy recognizes vertebral ligamentous articular strains. Likewise, we have cranial membranous articular strains. These cause restriction of the normal membranous articular functioning. Such restrictions alter cerebrospinal fluid fluctuation, the physiology of arterial and venous blood activity in the cranium, and also the physiology of lymph in the neck and head. At the moment of restriction in functions, intracranial pathology begins.

Because the sacrum is connected to the occiput by the intraspinal reciprocal tension membrane (the core-link between the cranial bowl and the pelvic bowl), traumatic events in the pelvic mechanism, from falls and situations involving momentum-inertia, may manifest an injury more obviously in the cranium than in the pelvis. This is particularly the case in postpartum depression or psychosis. In fact, it is impossible for a physician and osteopath to find the correct problem for his patients without considering and analyzing all the joints of the human body.

* * *

To clarify the movement of the sphenoid and the occiput, let us picture wheels with spokes. Visualize them as turning back and forth in place — that is, as circumrotating. As the sphenoid turns, the various locations on the wheel move as suggested by the spokes. The occiput also turns, and locations on it are moved in space. The two wheels turn at the same time. Thus, the sella turcica and the anterior end of the basilar process of the occiput both move upward as they flex, or increase the upward convexity of the clivus; and in extension both move downward, or decrease the upward convexity of the clivus. Extension is just the opposite of flexion.

The junction of the sphenoid and occiput in the clivus has the shape of an arch. It is somewhat like the kind of bridge over the Chicago River that opens up and closes down on both sides simultaneously. Although it closes down, the bridge remains an arch as it lowers. This point is important when visualizing the action at the sphenobasilar junction in technique. This junction is an area in the cranial mechanism that you cannot feel directly. You must visualize it. It is like the vertebral bodies in the spine: you cannot palpate the body of a vertebra, but you have a mental picture of it. You can touch the spinous and transverse processes and make an observation that tells you the position of the body. You can learn to tell the position at the junction between the body of the sphenoid and the basilar process of the occiput by the senses of touch and proprioception. This is not difficult, although it may seem so at first.

We might picture the falx cerebri and the tentorium cerebelli as cooperating with cranial articulations in physiologic movements rhythmic with those of the diaphragm. In this movement one might see the mastoid processes of the temporal bones rotating outward while exhaling and then returning inward while inhaling, with other cranial articulations cooperating. All of this action is in accommodation to the flow of blood and lymph in the body. The dovetail sutures in the cranium in some instances and the beveled articulations in others, coupled with experience, lead one further and further into the possibility of discovering more about the Old Doctor's science of osteopathy.[3] By digging on and on into the "holes" and the articulations in

3 In his later years, Dr. Still was respectfully referred to as the Old Doctor.

the cranial bowl, we may come to grasp the tail of the Old Doctor's "squirrel in the hole in the tree."

When we come to study the two temporal bones as they join in the movement of the cranial base, we first consider their form and their location between the sphenoid and occiput. Next, we note what the study of their articular surfaces tells us about the mechanics of their motion when the sphenoid and occiput circumrotate into flexion and extension at the sphenobasilar junction. This mental picture will give us the understanding of normal motion going on all the time in the cranial bowl.

From our understanding of the normal, we will be able to observe and mechanically interpret variations and abnormalities when they are present in our patients. For we need a working diagnosis before we come to consider lesions of this area and techniques for correcting them.

The temporal bones move like wobbling wheels. Note that the petrous portions are located on a diagonal that points forward into the head. When you study a disarticulated skull, place the temporal bones in the cranial base between the occiput and the sphenoid. Fit the grooves on the petrous portions onto the tongues on the sides of the basilar process of the occiput. This is the picture for motion — that is, the sliding pattern of motion that a tongue and groove articulation permits.

When the sphenoid and occiput move into flexion, the petrous portions rotate externally. When the sphenoid and occiput turn into extension, the petrous portions rotate internally. There is evidence on the outside of the skull of the comparative rotations of the petrous portions on the inside of the skull. This evidence can be palpated and used in the construction of a mental picture of the positions in the sphenobasilar area.

We can interpret the position of the basilar process of the occiput from the temporal bone because of the tongue and groove articulations between the basilar process and the petrous portions of the temporal bones. The mechanism of the movement between the occiput and the temporal bones is intricate. It needs detailed study. In some degree the temporal bones move with the occiput because they are carried by it on the jugular processes. The strange part lies in realizing that when the basilar process, as a spoke in the occipital wheel, turns, the petrous portions of the temporals turn along with it. Yet, at the same time, there is a motion between the two bones that resembles the motion between a fruit jar and its cap.

* * *

What is a cranial lesion? What is a membranous articular strain? In answer, suppose we use flexion as an example. If the sphenobasilar junction has moved a little beyond its normal range of movement in the direction of flexion and becomes fixed in that position, there will be a limitation of movement in the direction of extension. For diagnosis you will have all the appearances that go with the flexion position. When you test for motion you find that the area can move in the direction of flexion and you find that the area does not move in the direction of extension. You call this situation a *flexion* lesion. The opposite occurs with an *extension* lesion.

Then we have the possibility of other patterns that occur in the movements of the cranial base. The movement of *side-bending/rotation* at the sphenobasilar junction involves a pattern that brings the sphenoid and occiput high on one side and low on the other. On the high side they approximate, and on the low side they spread. Thus there is a comparative concavity on the high side and a comparative convexity on the low side. In the schematic design I call these positions for the side of the convexity. Thus, there is a pattern named *side-bending/rotation with the convexity to the right*, and there is a pattern named *side-bending/rotation with the convexity to the left*. When using the diagnostic tests for motion, follow the example given for flexion.

The pattern called *torsion* is simply a twist at the sphenobasilar junction. That is, the sphenoid turns one way on an anteroposterior axis, and the occiput turns the other way. Therefore there are two torsion patterns that are named for the position of the higher greater wing of the sphenoid. There is *torsion with the greater wing high on the right* and *torsion with the greater wing high on the left*. The same principle as described in the example of flexion is used in the diagnostic tests for motion. (For a more complete discussion of these patterns see p. 153 and Figure 16.) These are the basic patterns of position and movement that you work with in recognizing membranous articular strains of the cranium. The names are *flexion*, *extension*, *side-bending/rotation with the convexity to the right or left*, and *torsion with the greater wing high on the right or left*.

Editor's Note: Each person who is examined will be found to present one or another of these strain patterns. This usually represents the pattern the person has carried since infancy and is probably related to the mechanics of birth. Subsequent traumatic forces may have superimposed another strain pattern upon the original or even have caused the whole pattern to shift.

Dr. Sutherland always emphasized that these patterns of membranous articular strain are *schematic*. They serve as a framework for making observations that can be recorded and followed over the course of a treatment program.

While it is the membranous part that is strained, the total effect is manifested by the relations between the bones. Various types of lesions or strains are found in the cranium in clinical practice. The common findings are those at the sphenobasilar junction together with the implications for all the articulations in the total mechanism.

The impact of an external force entering the living cranial mechanism must be analyzed according to the particulars. It is well to remember that in such incidents there is likely to be more than one effect. These lesions are called the traumatic type. Analysis of the forces involved and the inertia in the situation provides a wide field for study. Particular strains may have occurred within the patient's body incidental to operations by surgeons and dentists, or when the patient was unconscious. Strains may have occurred when the patient was in a strained posture or when making an extreme exertion.

* * *

The mechanism is simple, as is common to all physiologic laws "not framed by human hand."

> I do not claim to be the author of this science of Osteopathy. No human hand framed its laws; I ask no greater honor than to have discovered it.[4]

When properly understood, the mechanism is the key to simple reduction of cranial membranous articular strains. I like the thought of rhythm in the membranes. It brings forth the necessity of recognizing tone quality with tactile sense rather than a mere manipulation of tissue. It is an expression of non-incisive surgical skill to secure balance in the laws attributed to the mechanism.

I draw on Dr. Still's teaching again: We must know the position and purpose of each bone and be thoroughly acquainted with each of its articulations. We must have a perfect image of the normal articulations that we wish to adjust.[5]

We, as mechanics of the human body, are mechanics of the science of *knowing* if we understand the fundamental principles of the primary respiratory mechanism. This is the importance of realizing the basics of this part of the living human body — the membranous articular strains in the cranium and their influence upon the rest of the body as seen in the science of osteopathy.

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4 Still, *Autobiography of A. T. Still*, p. 302.
5 Ibid., p. 277. (Adapted.)

TEN

Dysfunction in the Vascular System

THE SCIENCE OF OSTEOPATHY is simple. You realize that you are a mechanic of the fluids of the body, as well as of the skeletal system. The osseous tissues are also fluid. You can be the pharmacist because you are mixing the chemicals in "God's drug store," as Dr. Still called it. He said the body is God's drug store wherein you have all the drugs, lubricating oils, opiates, acids, and every quality of drug that the Wisdom of God thought necessary for human health and happiness.[1] He saw those things, and he had much difficulty, as I have said in the past, in trying to get others to see. That is, to see Dr. Still's vision, not mine. Somehow or other, the ground has to be prepared in order to get back to the *science of osteopathy*.

Learn not to swallow all the information that meets your eye. Study the human body — the animated human body as well as the cadaver. Study the life principle and come closer to understanding what we mean by the Breath of Life which Dr. Still did his very best to present, to point out, but which we were not ready for.

Think of that drug store, the choroid plexus, where you have an interchange between all the chemicals, between the cerebrospinal fluid and the arterial stream. See what you are getting:

1 Still, *Autobiography of A. T. Still*, p. 182.

an interchange between the chemicals in the cerebrospinal fluid and those in the blood, if you can think of it in that manner.

I want you to look into that third ventricle, up on the roof, and visualize that choroid plexus. On the anatomical specimen you find it all bunched up. Why? The patient died in exhalation and the mechanism drew back. The third ventricle came together.

What do the ventricular wings do during inhalation? They swing out and the third ventricle comes into a V-shape. During inhalation that choroid plexus that is on the roof of the third ventricle, not in it, stretches out. The roof is an apron between the inside and the outside, and the choroid plexus is on the outside of the brain. It is this roof that stretches out during inhalation and bunches up during exhalation when the walls of the third ventricle come together.

Do you see the mechanism — a mechanism all the way through? Then, follow the little arterial stream that runs up to that choroid plexus to feed it with arterial blood. Follow that stream of cerebrospinal fluid — where does it go? Follow the artery right out to that choroid plexus on the outside of the brain above the third ventricle and begin to think about what the experts say. They say that it is here that you find chemical interchange between the cerebrospinal fluid and the blood.

"Aha!" you say. Would it be possible for a cranial technician to change the movement of this mechanism? Could he thereby get a physiologic interchange here? If the mechanism was locked, could you restore the action of that mechanism so that there would be normal physiologic functioning to secure a normal interchange between the cerebrospinal fluid and the blood at all the choroid plexuses?

This possibility is what Dr. Still was directing you to in all of his writings. Where did the *science of osteopathy* come from to Dr. Still but from his Maker who understands the mechanism. That is why we have so many possibilities that are way beyond any other science claiming to do anything for this human mechanism in the way of repair. We may understand why we are mechanics. We are treating a mechanism. We are not applying grease or something of that kind as a therapy.

It is a "drug store" where we restore that mechanism so we have normal functioning or chemical interchange at the choroid plexus; we become the pharmacist within the brain, filling the prescription. Do you see it?

Then I look along and I find a venous channel that is different from the usual venous channels within the living body. I find that it is formed by a membrane in the cranium that has two walls, an inner and an outer. I think this way: Unless there is some mobility in the skull mechanism to move that venous blood along, there will be a stasis in the circulation of blood.

In the skull there is the outer membrane in which the bones are formed. It is rough on the outside and smooth on the inside. In the adult there is blood between the walls of the vault, which is formed in membrane. The walls of the dura mater separate to form venous channels in the folds created by the reduplications of the inner layer. The outermost wall (the bony vault) has little dovetail sutures that fit so as to provide expansion in compensating for articular mobility between the bones of the base, which are formed in cartilage. That same compensation movement moves the venous blood along.

My attention then turns to the grooves that go laterally along the inside of the occipital squama. I am stumped at first. Those grooves belong to the lateral, or transverse, sinuses. There is no compensation in this area for carrying venous blood along in that membranous wall.

A little further along I come to the posterior inferior angle of the parietal bone and I find a groove on the inside of that. The lateral sinus passes right across that angle of the parietal bone before it goes down to the jugular foramen. When I look at the articular surface on the posterior inferior angles of the parietal bones, I find corrugations and matching ones on the mastoid portions of the temporal bones. This arrangement shows that the parietals move in and out here in conjunction with the temporal bones. This movement moves the walls of the lateral sinuses, those membranous channels that carry venous blood.

Where does the blood in the lateral sinuses come from? The confluence of sinuses on the inside of the occipital squama receives venous blood from the superior sagittal sinus. This sinus begins to form at the front end of the falx cerebri and gets larger as it comes across the top of the head and down to the internal occipital protuberance. The lateral sinus also receives the blood from the straight sinus. The straight sinus forms where the falx cerebri and the tentorium cerebelli adjoin.

Where does the blood that enters the straight sinus come from? It comes from the inferior sagittal sinus in the free border of the falx cerebri and from the great cerebral vein of Galen. This vein has walls that are like the walls of veins outside the cranium. Therefore, there is a distinctly different tissue between the walls of the great cerebral vein and the walls of the straight sinus, which are taut fibrous walls of the dura mater.

The great cerebral vein receives the venous blood from the deep cerebral veins, from the cerebellar veins, and from the choroid plexuses we have been telling you about. You begin to wonder if this area where the great cerebral vein of Galen enters the straight sinus is not vulnerable to mechanical strains, especially when the infant head is adapting to the maternal pelvis during the mechanics of delivery at birth. Is this where tears may result in subdural hemorrhage? Is this one place where events may occur that result in a form of cerebral palsy?

Because of such possibilities, I must caution you about undertaking to change the position of the basilar process of the occiput by a contact on its undersurface through the mouth and nasopharynx. For one thing, you cannot do what you aim at because you can only push it back as a whole. You have no control in this situation over the consequences of such a technique. For another, there is a risk of a tear that would result in a subdural hemorrhage. I know of two instances where that happened. Furthermore, it is not necessary. You can use the tension in the fulcrum of the reciprocal tension membrane in this tripod arrangement much more easily and scientifically and with intelligence. Then the fluctuation of the cerebrospinal fluid, the natural agency of reduction, accomplishes the correction. Avoid pushing the mechanism further back and risking the possibility of causing an injury.

This system of carrying venous blood within the cranium to the exits at the jugular foramina is not the only system working to that end. There are the cavernous sinuses, which also have membranous walls, that begin at the superior orbital fissures where the ophthalmic veins enter. They move back along the sides of the body of the sphenoid and carry blood to the petrosal sinuses. What moves the blood along these large channels? We begin to reason that circumrotation of the sphenoid bone, taking a nosedive in inhalation, together with the roly-poly rotation of the petrous portions of the temporal bones, inward and outward, would move those walls. See how the mechanism of the reciprocal tension membrane, which moves and regulates the movement of the cranial bones, also serves as a mechanism that carries venous blood along the falx cerebri and the tentorium cerebelli.

* * *

Here is an exercise that will be beneficial in affording clean arterial refreshment to the brain cells, if nothing more.

> Get out into the open air and exhale deeply and slowly. As the diaphragm rises upward, draw the head downward and turn the mastoid processes of the temporal bones laterally, simultaneously. Pause a moment or two. Then inhale slowly. As the diaphragm

sinks downward elongate the neck and draw the mastoid processes simultaneously inward.[2]

According to my viewpoint, tensity in the falx cerebri and the tentorium cerebelli with restriction of the physiologic movement at the jugular foramina and in the postnasal tissues signifies incomplete drainage of the brain and facial regions. Complete drainage is as essential as complete drainage of old oil from the crankcase of an automobile motor before adding pure oil. Therefore, the importance of a pause after exhaling to allow the venous blood to drain thoroughly before filling up the "think tank." The pause holds the jugular foramina wide open and the postnasal tissues in relaxation, which allows complete drainage.[3]

As the formation of the jugular canal is half and half between the temporal bone and the occiput, it is likely that this provides for the physiologic expansion service that separates through a rotation movement of their articulations. The jugular foramen can be seen as resembling the intervertebral foramina in articular formation. Apparently, restriction in the rotation-articular-expansion service at the jugular foramina deserves an osteopathic consideration equal to that given to the occipitoatlantal osseous luxation. In my view, the restriction at the jugular foramen is of greater importance than the occipitoatlantal in relation to restriction of venous drainage from the internal cranial region.[4]

* * *

Lateral to the sphenobasilar junction we note the foramina lacerata and see the internal carotid arteries passing into the cranium through individual canals in the petrous portions of the temporal bones. As I have said, I believe the venous blood is carried along by membranous activity to the exits at the jugular

2 Adapted from: Sutherland, "Bedside Technique," *Contributions of Thought*, p. 28.
3 Ibid.
4 Ibid., p. 29.

foramina. Keep in mind that the main venous channels have walls decidedly different within the cranium from those without. The venous blood finds its way out of the cranium through exits formed by the articulation of two bones; the jugular foramina are examples. On the other hand, the arterial walls are the same within and without the cranium and have the same nerve supply. In addition, the arterial walls are protected on their way into the cranium by passing through individual canals in individual bones.

Thus, we may reason that membranous restriction disturbs the venous flow and the fluctuation of the cerebrospinal fluid. While cranial lesions may be primary, the intracranial membranes, including the dura and the arachnoid, are the real disturbing causation factors leading to disease or disturbed function in the brain.

Along comes the heavy vibration of the battlefield and you find the mechanism locked, just as sometimes there is a lock in the hydraulic brake system of your car. In some sudden emergency they lock right down. In the concussions of the battlefield a membranous shock may occur that locks down over all the fissures and sulci of the brain. This is followed by a disturbance in the fluctuation of the cerebrospinal fluid in the area, in the cortical area.

I saw many young soldiers returning from the battlefields land in San Francisco. They were young men with graying hair. I interpret this as a locking of that arachnoid membrane over the outside fissures of the neural tube. What would that do to the pia mater that carries blood supply to the perivascular spaces?

Study the effects of "sacral sag" and "fascial drag" on the entire vascular system, including the return of lymph to the heart. Have you heard Dr. Still's parable of the goat and the boulder? The goat comes down a mountain path and runs into a boulder, head on. His tail flops up. He backs up and starts over.

When he butts into the boulder this time his hind heels flop up. He backs up again, way up, and comes charging down the mountain path and slams into the boulder so that "the whole damn works flop up." (For a fuller discussion of this parable, see p. 214.)

In this parable the mountain path is the aorta. The boulder is the crura of the diaphragm where they cross above the aorta and the receptaculum chyli. The goat represents the valves of the heart behind the blood descending in the aorta. There is so much in the study of the crura: a drag on the fascia, on the central tendon of the diaphragm, on the mediastinal fascia that goes between the heart and lungs and then folds around back of the muscles of the neck. Did you ever stop to think that the prevertebral fascia goes up around the same muscles? That same fascia is in the area of the sympathetic ganglia that are the vasomotor regulators. That same fascia is attached to the outside of the basilar process of the occiput. You see that we are engineers of the human mechanical body, engineers of the highest quality.

When we slap on the sphygmomanometer to measure the blood pressure, we pump up the apparatus and back up the arterial stream. What have you up there in the instance of a cerebral hemorrhage but an arterial stream? The only occasions when I have used that apparatus have been to satisfy a life insurance company with figures for their records.

The Lymphatic System

See another protective system in the fundamental principle of the fluctuation of the cerebrospinal fluid taking care through the functioning of transmutation at the lymph nodes. That is, taking care of poison that has been gathered up by the lymphatic system. See how you can control that Tide with your ten fingers and intelligence. In the art of knowing your mechanism, you can bring this fundamental principle of the primary respiratory mechanism with its Intelligence, with its potency, to that short rhythmic period of its fluctuation. When you have brought the fluctuation to the still, quiet point you have an immediate interchange between all the fluids of the body. This includes the electrolysis in the lymph nodes that prepares the lymph for its return to the blood stream. It is like the demonstration that I gave with the glass of water through a transmitted vibration. (See p. 16.) Use this principle in your next case of inflammatory rheumatism or rheumatoid arthritis.

You will not see many cases of Hodgkin's disease, but the situation gives you something to think about with seeing, thinking, knowing fingers. You may have forgotten the information you have learned about the pathology involved. If the Old Doctor's "Ram of Reason" begins to bump your frontal lobes, you think about some of those streams that back up because there is a block somewhere in the exit of the river.

Here we have a vascular disturbance. I would say a backing up of something — a backing up of the lymphatics. There is a pretty big back-up and that makes for a pretty big causative factor in that pathology. At some time or other there has been a drag on the fascia — not only a pull on the fascia, but a drag on that important reciprocal tension membrane.

Where would we look for an obstruction in the main lymphatic drainage? The drainage of the entire body, excepting the right upper quadrant? Think of the thoracic duct leading from the receptaculum chyli, into which the lymph drainage from below is dumped. The lymph is then carried up the duct and emptied into the left subclavian vein. You think again of the Old Doctor's goat on the mountain path butting up against the boulder where the crura of the diaphragm cross above the aorta and the receptaculum chyli. Do you get the picture?

Now let us talk about the application of the science of osteopathy in securing regulation of the normal flow of the lymph stream. I hope to illustrate the application as a demonstration of non-incisive surgery. It is necessary in all applications to form a mental picture of the mechanism as the first step in the procedure. Note that the physical emptying of the lymph stream into the venous system occurs where the thoracic duct enters the left subclavian vein. The physiologic emptying requires a gentle and rather unique siphoning process in the thoracic duct.

This process can be assisted or facilitated by the use of feeling, seeing, thinking, knowing fingers. This guidance differs specifically from manual manipulation. During the application, fingers of one hand establish a contact over lymph nodes while a transmitted vibration is initiated through the other hand, which is placed on top of it. A quiet pause-rest should occur between applications.

The first application is to the upper left thorax near the axilla. The second is done with a lift to the area above the receptaculum chyli. The third application is at the great omentum, with a lift.

The transmitted vibration initiates the siphoning process. The first siphoning process occurs at the upper left thoracic area at the level of the axilla where you find nodes. If you don't find them, look for Chapman's Reflexes (see Glossary). Then go down to the epigastrium; the nodes are there. You will find them. Next, it is the same when you go down to the omentum and lift it. The object in lifting the great omentum is to tip it over, flop it over.

The nodes are there; those little things through which "finer nerves dwell than even with the eye."[5] That was meant to apply to the entire lymphatic system of the body. I can remember a patient, a veteran, with a bad case of lymph blockage with its resultant effects. When the blockage was released it was one of the most surprising results that ever occurred in the eyes of a

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5 See footnote on p. 33 for the full quotation.

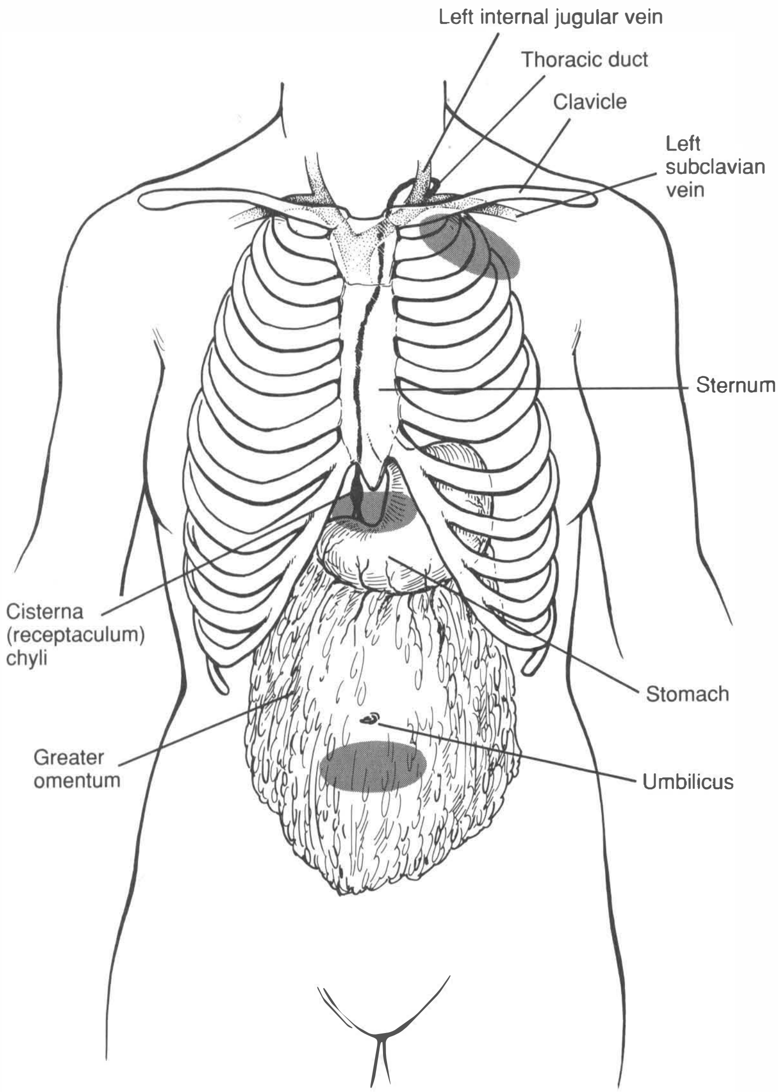

Figure 14. The areas of application for Dr. Sutherland's lymphatic treatment, showing the location of the junction between the thoracic duct and subclavian vein, the course of the thoracic duct, and the omentum.

physician. All that is involved is the goal of keeping things moving in their normal channels and through all the little nodes. The system is continually gathering up. It is the sewer system of the body, carrying off the metabolic wastes, the poisons, and the molecules that are closed to the capillaries. It is a beautiful system.

You have heard of Miller's Lymphatic Pump. It does the same thing through the secondary respiratory system.

Editor's Note: C. Earl Miller, D.O., taught a method in about 1920 for gently springing the upper rib cage with the intent of facilitating the movement of lymph.

With the method I described of facilitating the movement of lymph and controlling the Tide by bringing the fluctuation down to the short rhythmic period, you have the interchange between all the fluids of the body. Using the primary respiratory mechanism you don't have to go through that mechanical effort. By holding the walls of the fourth ventricle you have a transmutation. You deal with the motor that does the work through the primary respiratory centers in the floor of the fourth ventricle. You can reach the entire system through those physiologic centers.

You will hear me say from time to time that the arterial stream is supreme, but the cerebrospinal fluid is in command. I hope that you may understand how the cranial concept became a contribution of thought directing attention to a hitherto unexplored area or channel in the science of osteopathy. It is a thought that is in no way apart from the science of osteopathy. Get that. Nothing apart. It is not a specialty in itself; it is not simply a therapy. We are dealing with a *science*.[6]

6 Adapted from: Sutherland, *Contributions of Thought*, p. 132.

ELEVEN

Entrapment Neuropathy

It is important to visualize the nerve fibers and ganglia in relation to the motion of the bones for a full diagnostic picture of the problems that your patients bring to you. I will call your attention to some of my experiences with particular situations. Realize, however, that the possibilities are endless. Learn to look with your knowledge of the pathways taken by the nerves from their nuclei to their destinations. Above all, consider the picture of an infinitely small type of cranial strain.

Look at the sleeves of dura mater on the branches of the fifth cranial nerve as they leave the trigeminal ganglion. Focus attention on an infinitely small strain of the dural sleeve on the middle branch, the maxillary nerve, when a rotation of the petrous portion of the temporal bone has increased tension in the area. This is often the situation that exists in cases of tic douloureux. Imagine a man's discomfort when wearing a tight-fitting sleeve cuff. This is an appropriate illustration for comparison with the facial discomfort experienced in tic douloureux.

There is another very small situation to be recognized in tic douloureux. It is a specific, stretching strain on the maxillary-infraorbital nerve pathway. The tight-fitting dural sleeve may be affected by the course of the nerve around the small groove in the orbital process of the palatine bone and on around the groove in the maxilla to its exit at the infraorbital foramen below the zygoma.

I advise thorough investigation of infinitely small strains in the mechanics of the relationships between the palatine bones and the maxillae. Then, always consider effects on the sphenopalatine ganglion. This type of stretching strain may also be illustrated in the course of the sciatic nerve. There are specific places in these pathways where this problem of entrapment may appear.

Picture the effects of motion in the physiologic functioning of the trigeminal ganglion itself. It is located near the tip of the petrous portion of the temporal bone where the roly-poly action during rotation is regular all the time. See the rocking movement of the cribriform plate of the ethmoid in relation to the olfactory bulbs. Then see the "motion-vision" in the suspension of the ciliary ganglion in the orbits.

Note the possibilities for strain, in this way, in the area of the brain stem between the cerebral aqueduct and the central canal of the spinal cord — that is, along the floor of the fourth ventricle.

Editor's Note: This area is liable to torsional strain and strain by elongation or bending, thereby narrowing the lumen.

Recall the nuclei themselves and think of the pathways taken by the cranial nerves. With the exception of the first two, all the cranial nerves exit from the cranium, so think of the exits themselves. Realize the mechanics of the living brain in a mobile cranium in terms of possible strains under various conditions. Look to the exits of all the cranial nerves to see if there is enough room for them to pass.

Think especially of the jugular foramina. They resemble intervertebral foramina, and the petrous portions of the temporal bones resemble the necks of ribs. What is there at the jugular foramen besides the internal jugular vein? The ninth, tenth, and eleventh cranial nerves on their way out of the cranium. Could changes in the size and shape of that foramen, formed by two bones, result in entrapment neuropathy? It is possible.

Let us look at ribs and their vertebrae. Consider the effect of a minute strain in the normal articular movement of the heads of the ribs that could disturb the nearby sympathetic ganglia. At the same time, look at strains between related vertebrae and the effect on intercostal nerves, remembering the distribution of those nerves. View the entire nerve pathway of a pain signal to the dorsal root ganglion in terms of mechanical factors that could disturb function and comfort. This is clearly indicated in cases of intercostal neuralgia, neuritis, and shingles (herpes zoster).

A rib rotates externally and internally in inhalation and exhalation, just as all paired lateral structures elsewhere, in relation to the midline structures. Visualize the neck of the rib. Does it remind you of the movement of a Venetian blind? When the blinds are closed there is quite a space between them and the windowpane. Look at the necks of all the ribs on both sides of the posterior wall of the thorax. Turn the ribs in your mind's eye as Venetian blinds turn, and see the change in the space between the rib and the tissue in front of it — namely, the lungs. Visualize the prevertebral fascia that runs in close approximation to the sympathetic ganglia and blood vessels. What occurs when the blinds, the necks of the ribs, go into internal rotation or external rotation? The action changes the space, the prevertebral space between the ribs and the lungs. Suppose one of those blinds (ribs) becomes luxated in either external or internal rotation in connection with a disturbance to the functional physiology of the lateral chain ganglia — the sympathetic ganglia. What occurs in the close approximation of that ganglia to the head of a rib if the rib is held in one position? You have the same sort of disturbance that you have when that little thing called the sphenopalatine ganglion is not functioning well.

Suppose you have a patient with hyperextension in an area of the upper or middle thoracic spine. You have worked to effect a change but have made no progress. Why don't you get the result you have worked for? The head of a rib is holding the related vertebrae in that position.

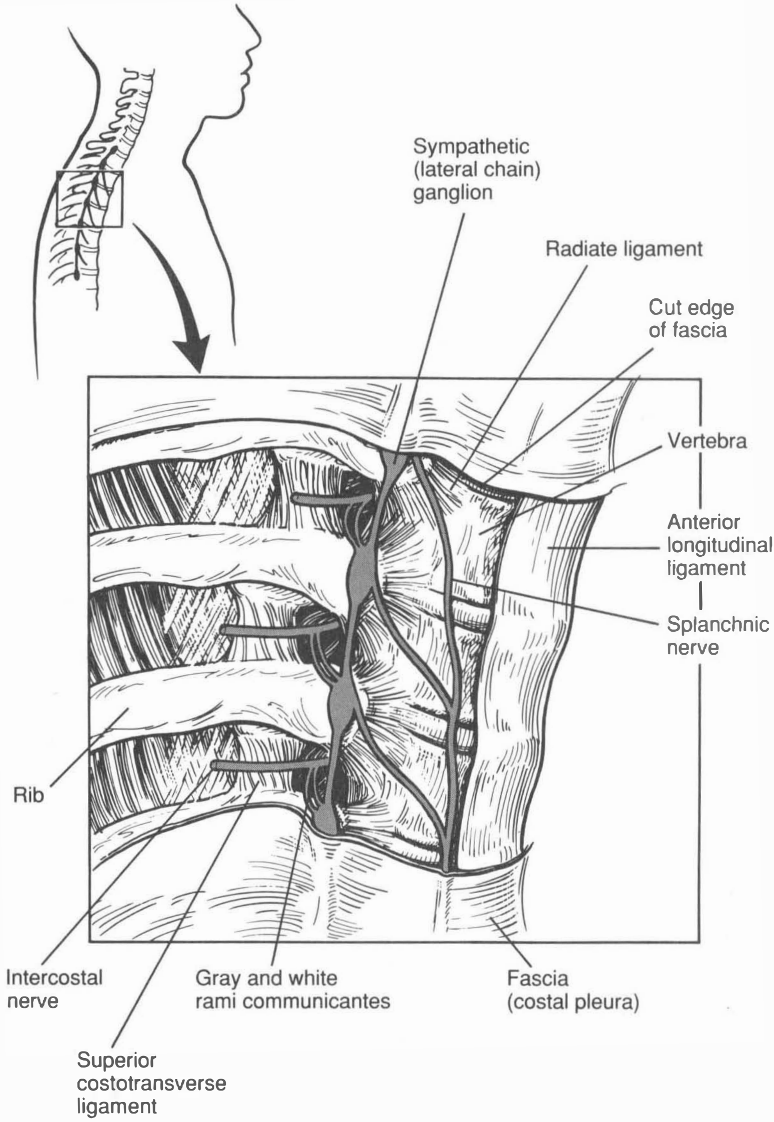

Figure 15A. The anterior surface of the posterior thoracic wall, showing the relationship of the sympathetic (lateral chain) ganglia to the costovertebral junctions.

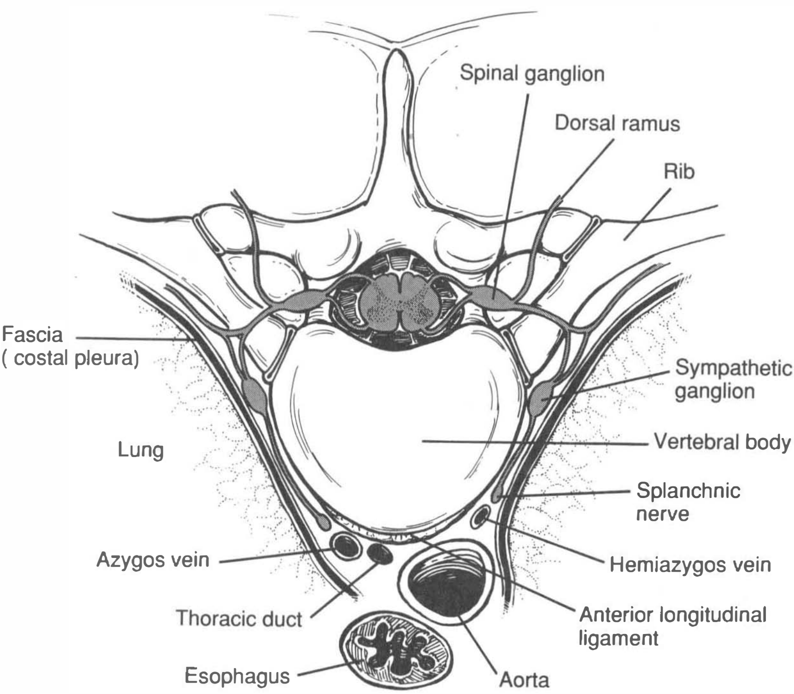

Figure 15B. A transverse cross-section of the costovertebral junction, showing its relationship to a sympathetic (lateral chain) ganglion.

To treat this condition, all you have to do is to hold the bolt — that is the rib — in a position. It makes no difference whether you hold it in internal or external rotation. You hold the bolt and ask the patient to turn the nut — that is, the facet, or facets, of the related vertebrae. The patient does this by turning the opposite shoulder, or perhaps just his head, away. With respiratory cooperation added to this postural cooperation, the ligaments related to the joints involved that have held the head of the rib in the facet will bring it back into normal relationship. Use the same postural cooperation and respiratory cooperation with the corresponding rib on the other side. (For a discussion of the nut and bolt principle, see p. 189.)

What happens to this so-called chronic lesion in extension in the thoracic area when the normal freedom of movement is restored? The same results that you found when releasing strains in the cranium. Entrapment neuropathy is removed.

TWELVE

Trauma

Editor's Note: There are three considerations when thinking about the living human body, including the head. The first is the view of the involuntary physiology that is going on all the time, including its mechanical aspects. In this view we see the flexion and extension of midline structures together with the external rotation and internal rotation of paired lateral structures.

The second is the adaptation that this living structure makes to various postural stresses and strains, thus creating patterns that are observed in an osteopathic structural examination. Such patterns are the expression in the adult of the small strains that occurred in infancy and became larger with growth, the "bent twig" phenomenon.

The third consideration is trauma, in the sense of injury from the impact of an external force upon the living head. If the head as a whole can move with such a force in translation, the impact upon the mechanism is minimized. However, the effects of momentum-inertia (when a moving object meets with a stationary one) present a spectrum of severity and also an infinite variety of extended consequences. This short lecture by Dr. Sutherland does not exhaust what he had to say on this subject over the years of his teaching.

THE CONSEQUENCES OF TRAUMA to the head are frequently encountered in osteopathic practice. Cranial membranous articular strains often result from operations done for some other problem. A simple procedure such as extraction of a tooth can incidentally create a strain in the facial mechanism or even in the posterior cranial fossa. The great improvement in the manner of transporting injured people has prevented many secondary injuries that were formerly found. It has been recognized that an injured or unconscious human body is vulnerable to incidental strains because the muscular tonus that protects the joints is not working. The ligaments permit a wider range of motion under these circumstances, which leads to stresses and strains that develop subsequently.

In the emergencies that require primary attention to another area, there often are lesser injuries that should not be forgotten. It is possible for many injuries to occur in a single incident. Physicians must first attend to those requiring urgent attention. However, many injuries do not manifest until some time has passed. If these are not addressed at some point, they provide the background for later troubles. An exhaustive examination that attends to all the small injuries related to the incident should be made at an appropriate time for the long term benefit of the patient.

There are numerous traumatic effects created by incidents involving momentum-inertia. In addition, there are various types of cranial membranous articular strains that follow the direct impact of an external force. These local events are to be analyzed in terms of the local anatomy. Should mental and emotional stress be added to these conditions, the effects become intensified. Shell shock and concussion in the environment also constitute external forces that make an impact upon the cranial mechanism.

When the facts of a traumatic incident are known, the lesion is named for the bone that received the impact, first, and its neighbors, second. For instance, a blow on the forehead may drive the frontal bone(s) into the coronal suture beneath the parietals. This is named a frontoparietal lesion. Should the impact have been upon the parietal, the name would be a parietofrontal lesion.

When I was very young I had a brother, Steve, who got me into trouble. He would climb aloft some high tree and jump off. He landed on nimble feet. I bumped down upon my tuberosities. When you jump off a height and land on straight legs, or fall off and land on your tuberosities, you are experiencing momentum-inertia in the landing — and not just in one place.

Consider the cisterna magna, the body of cerebrospinal fluid in the subarachnoid space of the posterior cranial fossa. When momentum-inertia arrives there, the medulla oblongata may settle into the foramen magnum as the cerebellum flops downward over it and the cerebrospinal fluid gets pushed out. This picture is simply offered to point out what can occur in this type of cranial membranous articular strain. You might say that the cerebellum has flopped down upon the fourth ventricle, compressing it, or maybe an occipitomastoid lesion has been produced.

Turn the name around to call it a mastoid-occipital lesion. It is a possibility because a force can come on the temporal bone rather than on the occiput. You get the same effect. You get a pinch on that important area. What a dull feeling it is that follows. You will also find that problem (an occipitomastoid lesion) in many patients with psychiatric problems.

There is another cistern, one called the cisterna interpeduncularis. It is right over the sella turcica where a blow on the top of the head may force a similar type of compression that pushes the fluid out. Here it would crowd the optic chiasm. Sometimes it affects the retina of the eyeball and there is papilledema.

The arachnoid membrane does not go into the fissures and sulci of the cerebral cortex as does the pia mater. These leptomeninges contain the distribution of the cerebrospinal fluid on the outside of the neural tube. The arachnoid membrane stretches across the fissures. Along come the heavy vibrations of the battlefield or some such concussion, and lock that membrane down on the cerebral cortex, which has the consistency of soft custard. A disturbance in the fluctuation of the fluid in the cortical area results. In accidents involving momentum together with a collision with a stationary object, creating a "whiplashing" effect, there is apt to be a concussion within the cranium and a contrecoup effect. Attention to the management of the fluctuation of the cerebrospinal fluid with a restoration of normal conditions soon after such a traumatic event can prevent the development of a postconcussion syndrome. It is possible to improve the conditions of this syndrome long after the accident, but it is better to prevent it.

Suppose you receive a blow on the frontal bone near the frontozygomatic angle. Do you see how that might drive the little palatine bone onto the sphenopalatine ganglion? Depending on the direction of such a force you might find a locking of the sphenozygomatic articulation in the lateral wall of the orbit. Under sufficiently severe conditions there might be a fracture in the lateral wall of the orbit. Such factors in this area can also lock up the motion of the sphenoid.

It is well to consider the fact that the petrous portion of the temporal bone not only rotates internally and externally in relation to the basilar process of the occiput, it also glides medially and laterally. A golf ball speeding through the air and landing on the mastoid portion of the temporal bone just behind the auricle has been known to drive the petrous portion medially into the cranial base, with complex clinical problems for the patient resulting. On the other hand, a fall with the occipital squama landing on the sidewalk can produce conditions which occasion the temporal bone to glide straight out of the side of the head. Careful use of the principle of balanced membranous tension will aid the prompt return to normal. The patient is amazed by the sudden difference.

* * *

The following are anatomical conditions tending to minimize the effects of violence inflicted upon the skull:

1. The density and mobility of the scalp.
2. The domelike shape of the skull, which will bear relatively hard blows and also allow them to glide off.
3. The number of bones, which tends to break up the force of a blow.
4. The sutures, which interrupt the transmission of violence.
5. The intersutural membrane, which acts, in early life, as a linear buffer.
6. The elasticity of the outer layer.
7. The overlapping of some bones (*e.g.* the parietal by the temporal squama), and the alternate beveling of adjacent bones (*e.g.* at the coronal suture).
8. The presence of ribs, or groins (*e.g.* from the crista galli to the internal occipital protuberance, from the root of the nose to the zygoma, the temporal ridge from orbit to mastoid, from mastoid to mastoid, from the external occipital protuberance to the foramen magnum).
9. Buttresses (*e.g.* zygomatic process and greater wing of the sphenoid).
10. Mobility of the head upon the spine.[1]

1 Adapted from: Sir Henry Morris, *Human Anatomy*, 10th ed. (Philadelphia, 1942), p. 120.

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THIRTEEN

Diagnosis and Treatment

DIAGNOSIS

THERE ARE SEVERAL PRINCIPLES that I have used in the process of making a diagnosis of the situation in the living head. The first consideration in this process is the use of your hands for palpation and the tests for motion. You may use your sense of touch as well as your sight to make observations of the shape of the head and face as a whole and in detail. You may feel numerous landmarks, the size and shape of individual bones, and outline the sutures. This initial study is relatively superficial, but it is the background within which you place further findings.

When palpating let your fingers light gently on the skull, on the abdomen, or anywhere on the patient's body. Let your hands be like the bird lighting on the branch of a tree, quietly touching and then settling down over the area. While your fingers are there feeling, seeing, thinking, and knowing, they can tell you more in one minute than a firm grasp can gain in an hour's observation. You will train them to observe without interfering. If you try to grasp the vault firmly you are not going to learn much because you will be mixing the sense of touch, the proprioceptive sense, and the motive power of the hand.

Now, I will tell you about the use of contacts on the vault for finding and understanding what is going on in the articular mechanism of the cranial base. I must mention first that you cannot feel the articulations of the bones in the base directly. Therefore your vault contacts will tell you two things: facts about the vault itself and facts about the base that you learn through the vault.

The manual contact that I have found most useful in the management of the cranial vault for the diagnosis of motion in the cranial base can be thought of as a pair of pliers. That is, both the hands and arms together function like that tool. This is a modification of the contact that Dr. Still taught in his "wrist technique." For the vault contact, the operator is seated at the end of the table with the patient supine on the table. The operator places the palmar surface of his hands on the parietal bones, the vault, of his patient. His thumbs are crossed *above* the vertex and his arms are relaxed from the shoulders. This arrangement forms the pair of pliers. The palmar surface of the digits is to be adapted to the patient's head so that they can be used. The crossing of the thumbs makes a little fulcrum, like the fulcrum in a pair of pliers. The forearms of the operator become the handles of the pliers.

Editor's Note: Dr. Still's "wrist technique" is described and illustrated in the Appendix, Figure A.27. In this technique the operator can use the muscles of his forearms for a very short leverage on the field of operation. It is not possible to strain the joints of the wrist with this control of the field and it is possible to move the bones within his grasp.

Then you learn to use the muscles of the forearm, the flexors, to control your contacts on the patient. The operator uses the flexor digitorum profundus and the flexor pollicis longus in the development of his manual skills. Notice in my demonstration of this vault contact that my fingers are not sticking out way down on the sides of the patient's head. I cannot manage the cranial base that way. My contact on the parietal bones is with the palmar surface of the proximal parts of my digits up on top and back of the parietal eminences. The contact is plastic, not gripping, and permits me to lift slightly as the parietals move out laterally. They move anterolaterally at the posterior inferior angles. The movement at this angle is also upward and is more than the movement of the anterior inferior angles. The articular gears simply carry the movement right along once it is started in the direction of external rotation. This direction is the movement that occurs when the sphenobasilar junction moves into its flexion position.

All you do is start the vault moving toward its flexion position — that is, give it a little "kick-off." The fluid, the Tide, carries it on to its range of flexion movement. You do not force the movement beyond the range that occurs when the fluid carries on what you have started. The same procedure is used to start the movement into extension. All you have to do is to change the fulcrum, the crossed thumbs, through the handles, the forearms. Use a *little* compression, followed by turning the parietal bones in the direction of internal rotation. This starts the movement at the sphenobasilar junction into extension. In this way you can diagnose whether the cranial base moves further into flexion than into extension or vice versa. You will know because you have not forced anything. You have only allowed the Tide to carry the vault to its normal range of movement in flexion and extension.

The Side-Bending/Rotation and Torsion Patterns

The next diagnostic procedure to demonstrate is the pattern of side-bending/rotation at the sphenobasilar junction. The hands are on the vault just as they were when testing for flexion and extension. The thumbs are crossed above the vertex so that my arms can serve as handles. Then place an index finger on the squama of the frontal bone(s), and place another finger — perhaps the ring finger — on the posterior inferior angle of the parietal bones.

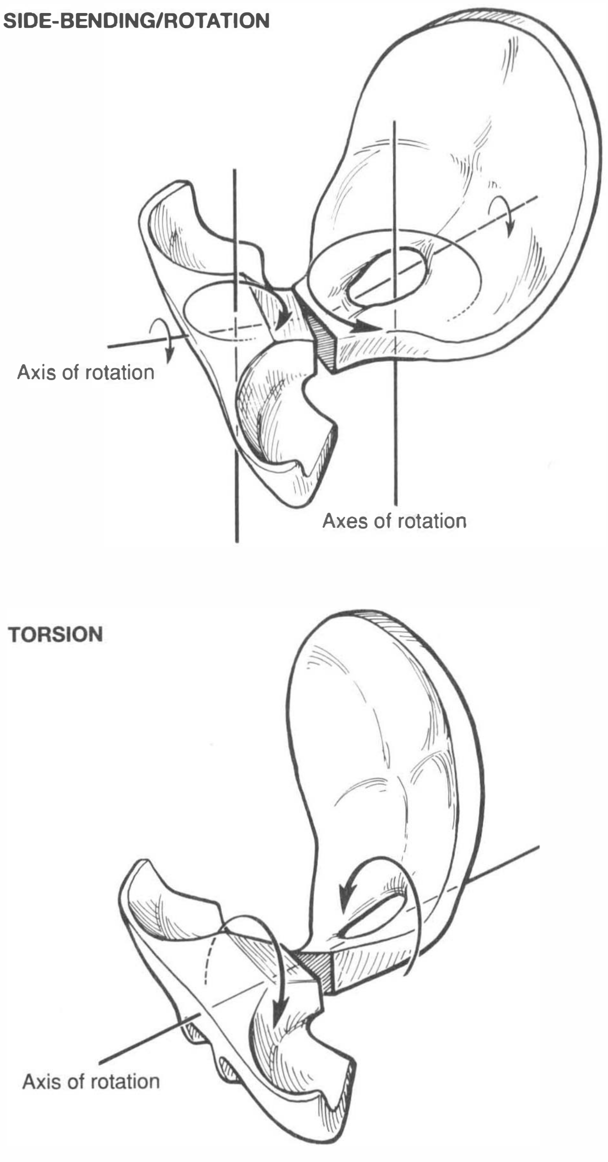

Figure 16. Schematic patterns of the sphenobasilar junction.
side-bending/rotation and torsion the sphenoid and occiput rotate in opposite directions about the axes indicated.

a.
wing of the sphenoid and the occiput are lower on the side of the convexity.

b.
on the side of the high great wing.

Approximate the two fingers on the side of the concavity and spread the two fingers on the side of the convexity to make a bend. Note the contact of the thumbs where they cross. See that the fulcrum shifts when the fingers that are spreading move downward as rotation occurs with the side-bending.

Again you just start the action and the Tide carries it into side-bending/rotation. With this pattern the greater wing of the sphenoid on the side where you approximated your fingers moves upward. The greater wing on the side where you spread your fingers, the side of the convexity, lowers. At the sphenobasilar junction, the body of the sphenoid and the basilar process of the occiput rise together on one side and lower together on the other side. This rotation occurs because of that arch of the clivus. Side-bending cannot occur without some rotation.

What do the temporal bones do when the sphenobasilar junction moves into the pattern of side-bending/rotation, convex to the right or to the left? You can feel the temporal bones with your fingers at the mastoid angles of the parietals, as the mastoid portion of the temporal bones articulate with the posterior inferior angle of the parietal bones. You can feel them move in and out at the parietomastoid articulation. Because you know the mechanism, you can understand the internal and external rotation of the petrous portions through what you feel happening at the parietomastoid articulation.

When you want to test for the torsion pattern, you keep your index finger on the frontal squama and make a contact with your little finger on the occipital squama, the interparietal occiput. Only the index finger on one side and the little finger on the opposite side are going to do any work. The other fingers are at rest as they lay on the head and the thumbs are crossed. The torsion pattern involves a twist at the sphenobasilar junction. It is named for the higher greater wing of the sphenoid; for the sphenoid has turned on its anteroposterior axis, and one greater wing is higher than the other. It follows that the occiput has turned to become higher on the side where the greater wing has lowered.

In this case you just start the movement and observe that the mechanism carries along to its full excursion in the direction started. With one index finger lift the greater wing of the sphenoid on one side, and with the little finger of the other hand lift the occiput on the other side. [The direction of the lift is cephalad. –Ed.] When this torsion pattern responds to your action, you feel the response at the sphenobasilar junction right away. Then you allow the mechanism to return to neutral and test for torsion in the other direction. The response is observed in the same way.

When these responses are back to neutral you make comparisons of promptness, freedom, and range of excursion to draw your diagnostic conclusions. The conclusions are determined by the directions in which the bones move most promptly, freely, and fully. When strains exist there is more movement in one direction and limitation in the other. The strain pattern is named for the direction of the freer, more extreme movement. I have used this schematic routine so that my records tell me of the diagnostic facts for each patient visit. It is also a scheme that is useful in teaching. It is not an absolute way for the mechanism to work.

Observation of movement as well as of position and shape is possible when you become familiar with the normal landmarks. You can look at the living human head and see the bones moving. In the flexion position you see the parietals moving externally. With extension you see them coming into internal rotation. If you are looking at the face, you see the orbits widening and narrowing and the eyeballs coming forward when the cranial base is in flexion and receding when the base moves into extension.

When there is a side-bending/rotation pattern in the cranial base, watch the zygoma on the side of the higher greater wing move externally. Then see the zygoma on the other side, where the greater wing is lower, coming into internal rotation.

[When the zygoma externally rotates, the cheek bone is flattened and appears less prominent. With internal rotation it appears sharper and more prominent. –Ed.] You can see it move, and you can see the change occurring along the metopic suture. You can also feel these movements and the changes that follow from them. Observation by sight and palpation provides information about position and movement. Make a diagnosis of pattern by simply putting your hands on the vault.

At the same time that you are studying flexion, extension, sidebending/rotation, and torsion patterns in this way, you can also observe the fluctuations of the cerebrospinal fluid Tide. You can make a diagnosis of the Tide. Where there is a limitation of some sort you can feel a thump-thump. It is not a pulse beat. You can amplify this effect in several ways using postural cooperation and respiratory cooperation by the patient. All this and more is accessible through the management of the vault contacts. (A fuller discussion of diagnosis using the Tide is on p. 166.)

Editor's Note: At the courses that were recorded, Dr. Sutherland gave a second lecture on the subject of diagnosis. It is included here for the further elaboration of some key concepts.

What is the principle that I have found so useful in diagnosis and treatment that resembles the "wrist-technique" that Dr. Still taught? It is the principle of letting the hands light gently on the vault, wrist, foot, or any other region and settle into the contacts so as to be aware of the action within, so as to feel what is going on. The living action is perceptible if your hands are quiet and your attention is on what is there to be felt. If you grasp your contacts vigorously, you stop the motion that you want to feel. You have interfered with it. If you do not interfere, the motion within carries your hands enough to register in your proprioceptive sensory pathway. You know the motion because you have felt it.

What have I been pointing to in considering and using the tendons of your fingers and the one muscle that moves them? The belly of the flexor digitorum profundus lies on the flexor surface of the radioulnar interosseous membrane and the tendons go across the wrist and palm, then cross the palmar surface of the proximal phalangeal joints of the hand to insert into the distal phalanges. One muscle moves the fingers. The joints that are passed over are therefore controlled in their movement by the one muscle. The application to strains in the wrist is clear. I have modified it in applying the principle to the cranial vault when managing the movement of the joints of the cranial base. It is a precise scientific operation. It is not a vague manipulation.

Editor's Note: In comparing the mechanism of the forearm to the cranium, Dr. Sutherland notes that in both cases there are joints that are moved without direct attachment to the agency of that movement. In the forearm there is one muscle with four tendons that cross and move many joints. In the cranium there are the three sickles of the reciprocal tension membrane that pass over the cranial base and move those articulations.

What do you do when you want to start a pattern of sidebending/rotation in the cranial base with the vault contact? Let us say that you want the greater wing of the sphenoid to go up on the right side and the basilar process of the occiput to tip up on the same side. [The base of the sphenoid rises concomitantly with the greater wing –Ed.] Suppose that you have already learned that the patient's base moves more freely in the direction of extension. Using the vault contact you simply spring the parietals inward and approximate your fingers on the right side of the head.

You can see the parietal "eaves" move in as the sagittal suture rises to form a slight ridge. You see the zygomatic angles of the frontal squama moving inward and the metopic suture moving forward. The zygomatic bones move toward internal rotation, and you may observe the frontal processes of the maxillae turn more into the sagittal plane. Then you feel the right side of the head rise and the left side lower as the sphenobasilar junction side-bends and rotates with the convexity to the left. As this response is completed, you allow the mechanism to return to its neutral position.

What do you do when you want to test for motion in the sphenobasilar junction in the pattern of torsion with the greater wing high on the left? Again, you consider whether the base is more free in flexion or extension because the other patterns occur more clearly according to the fact of that finding. The movement of the sphenoid and occiput in their regular physiologic excursion is around a transverse axis. The movement in the torsion pattern is around an anteroposterior axis through the body of the sphenoid and the basilar process of the occiput. Therefore, when one greater wing rises, the other lowers. In torsion, which is a twist at the sphenobasilar junction, the basilar process turns at the same time so that it is tipped up on the side of the lower greater wing. It follows that the occiput is lower on the side of the high greater wing.

In the torsion pattern, because of the occiput's rotation on its anteroposterior axis, the basilar process turns so as to be up on one side and down on the other. The temporal bones, as is the general rule, move with the occiput. Whenever the basilar process of the occiput is tipped up on its side, the temporal bone is carried into its internal rotation position. On the side where the basilar process tips downward, the petrous portion rolls into its position of external rotation.

Likewise, you will see in the torsion pattern that where the greater wing moves upward, the zygomatic bone is carried into external rotation. On the side where the greater wing goes downward, you see the zygomatic bone being carried into internal rotation. You see something else too: you can see that eyeball narrowing and becoming elongated, the shape associated with nearsightedness. On the other side, the side of the higher greater wing, that eyeball comes forward as the orbit widens. Thus, there are difficulties for the optometrist who engages to help in the fitting of lenses for better vision.

When the normal physiologic patterns of flexion and extension are dominant, the diagnosis is easier. This is when the sphenoid and occiput are turning on their parallel transverse axes. With the flexion pattern, the orbits widen and the eyeballs come forward to favor farsightedness. When the extension pattern is dominant, the orbital cavities become elongated and more narrow, molding that vascular organ, the eyeball, into the shape that favors nearsightedness.

You have seen that the sphenoid and occiput turn on a vertical axis when moving into the side-bending pattern and that they must also turn on the anteroposterior axis, which causes them to rotate. The manifestation of the side-bending/rotation pattern is a concavity on the high side and a convexity on the low side. Therefore, the operator converges his fingers on the high side and spreads them on the low side to "kick-off" the mechanism for testing in this pattern. This is named for the side of the convexity in my schematic design.

You can feel the temporal bone on the high side, the side of the concavity, moving into internal rotation. You can feel the one on the side of the convexity moving into external rotation. You will also feel the rotation when the sphenoid and the basilar process move downward on the side of the convexity.

If you watch closely, you can see the zygomatic bone on the side of the higher greater wing move into external rotation. The zygomatic bone on the low side then will go into internal rotation. Watch the eyeballs in this situation. See the angle of the frontal bone on the side of the higher greater wing moving forward and out as the angle on the lower wing moves inward and back. I never watched the frontal eminences, but I have seen the frontal processes of the maxillae turning. They turn more into the coronal plane with external rotation and more into the sagittal plane with internal rotation.

Application of these tests for motion in these several patterns through vault control is easy. As with flexion and extension, all you have to do is to start the mechanism in the direction under study. That is why we want you to practice it, so that you will become precise and perfect in the art of *knowing*, the *art* in the science of osteopathy.

Lateral and Vertical Strain Patterns

We now come to the study of patterns that are the result of external force or forces upon the mechanism from without. These forces may have been active in the process of birth between the passenger and the passageway, or they may have been active only recently in the experience of an adult patient. In any case, the head as well as any other part of the body responds to external force according to the intensity of the force; the mechanics of the place of impact; and whether the force is translated, and thereby dissipated, or absorbed into the mechanism, thereby causing strain.

There are certain possibilities for motion in response to an external force in the cranial base. These patterns are not physiologic, but within limits they can be tolerated without disturbing vital functions. I have named them for what happens at the sphenobasilar junction, but what you see in the shape of the head as a whole is often a puzzle in diagnosis.

One of the puzzles you will encounter in diagnosis once in a while is conflicting evidence. You may see an extension type head below and a flexion type vault above. Or, you may find just the opposite, a flexion base with an extension vault. What happened? The answer lies in an understanding of the condylar parts of the occiput and their influence upon the whole mechanism.

The anatomic specimens, the skulls, give you a variety of cues. The prominent cue is the shape of the foramen magnum. Analyze the conditions that enter into the formation of the foramen magnum in all the specimens that come to your attention. See the changes in the shape of the "hole in the tree" (the foramen magnum). Visualize the implications of your observations and analysis of the outside of the skulls for the spaces on the inside of each skull. In your mental pictures, locate the falx cerebri and the tentorium cerebelli as they enter into the formation of the spaces that contain the brain stem, the cerebellum, and the lobes of the cerebral hemispheres.

For instance, a misshapen skull may show a crowded hemisphere on one side and an expanded one on the other. The situations can be analyzed so that the functional effects are diagnosed. The science of osteopathy points the way to visualizing changes in the shape of spaces so that improvements in the related functions may be devised.

When you are puzzled about the meaning of conflicting evidence, you can reason that a special pattern is present in the sphenobasilar junction. That may be a "bent twig" situation or a response to an external force. For, in addition to the patterns of side-bending/rotation and torsion, strains in other directions are possible. I call these possible patterns *lateral strains* and *vertical strains*. This means that the body of the sphenoid and the basilar process of the occiput have been moved so that they have glided either up or down or from side to side in relation to each other.

There may be a vertical strain with the base of the sphenoid high and the base of the occiput low or with the sphenoid low and the occiput high. There may be a lateral strain with the base of the sphenoid to the left and the base of the occiput to the right or with the sphenoid to the right and the occiput to the left. It is convenient to name these patterns for the position of the sphenoid body, the position of the basilar process of the occiput being implied.

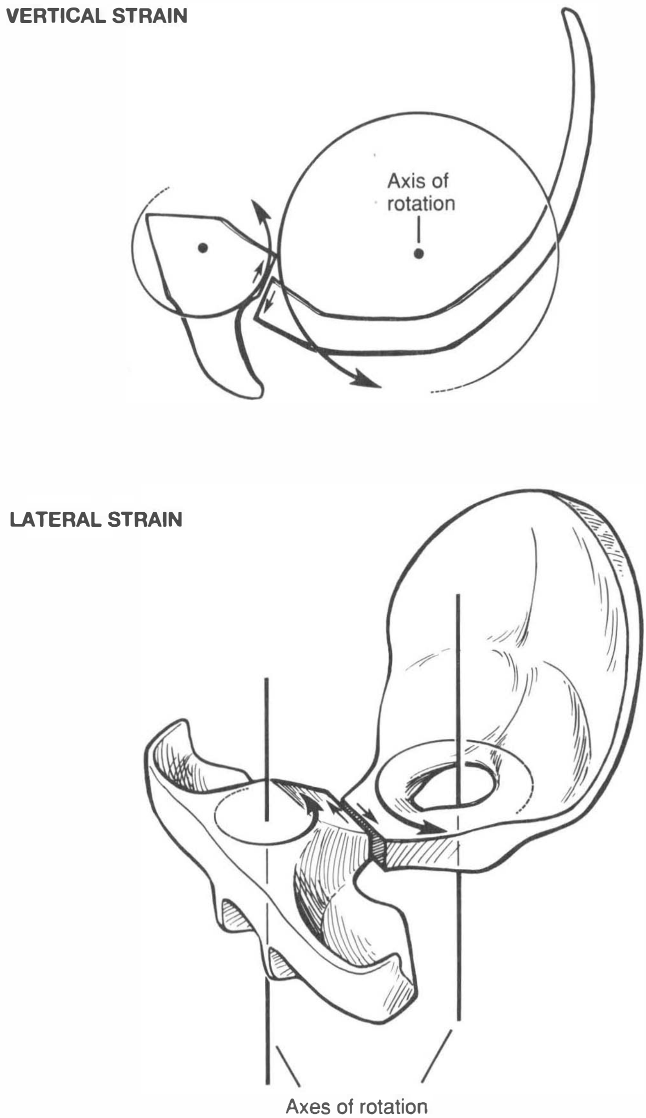

Figure 17. Schematic patterns of the sphenobasilar junction.
tical and lateral strain patterns the sphenoid and occiput rotate in the same direction around parallel axes.

a.
   the sphenoid is relatively elevated with the base of the occiput relatively depressed.

b.
   sphenoid is relatively displaced to the right with the base of the occiput relatively displaced to the left.

Under some circumstances the cranial base may be compressed by traumatic forces. These forces upon the adult head manifest as compression at the articulations. In infants and children trauma can also produce compression, and in addition, the forces that simply accrue with growth can cause a pre-existing pattern to become compressed. Some have called these patients "children with tight heads." When your diagnostic procedures reveal this condition, it is called simply *compression of the cranial base*.

I use the vault contact for systematic diagnosis of conditions and patterns of the cranial base. This includes the full use of all the tests for motion in all the patterns I have described. You may use other contacts and create your own diagnostic routine and arrive at the same understanding of your patient's mechanism at any given visit. The visual and palpatory observation routine provides you with much detail that increases your understanding of what can be realized about the shape of spaces on the inside from your diagnosis of the outside.

I want to emphasize again the value of visualizing the sphenoid and occiput as wheels. In that picture you can locate a particular place along a spoke of the wheel or on its circumference. Locate the foramen magnum on the occipital wheel. See that when the occiput turns into the direction of flexion, the foramen magnum moves forward and up a little. The same is true when the sphenoid turns in circumrotation. All the spokes on the wheel are turned to a different place in space. This fact may help you in your understanding.

The Sacrum in Relation to the Cranial Base

Focus your attention now on the foramen magnum of the occiput. The intraspinal dura mater, a continuation of the inner layer of the cranial dura mater and its reduplications, has a firm attachment to the rim of the foramen magnum. It is not attached to the atlas but to the bodies of the second and third cervical vertebrae — that is, to the posterior longitudinal spinal ligament at that level. From there, it hangs like a hollow tube down the spinal canal until it reaches the sacrum. (For a description of dural sac anatomy based on more recent anatomic studies, see the editor's note on p. 26.)

In the sacral canal the intraspinal dura mater is attached to the posterior longitudinal spinal ligament at the level of the second sacral segment. As the membrane is nonextensible, you can understand that when the occiput moves a little forward and up in inhalation, the foramen magnum and the membrane attached to it are carried forward and up a little, too. See the membrane rising and taking the sacrum along with it. This is the *reciprocal tension membrane* of the spinal canal, the intraspinal reciprocal tension membrane.

What effect does this action have on the sacrum? The sacrum is suspended beneath the ilia by two L-shaped articulations. In inhalation the base of the sacrum is lifted into a posterior position, and the apex is moved forward. Then, during exhalation the spoke, the foramen magnum, drops back in the lower level, and the sacral base drops forward into its extension position. In that position the apex of the sacrum moves posteriorly. This is a discussion of the principle of the reciprocal tension membrane of the spinal canal that connects the foramen magnum of the occiput with the second sacral segment. You are going to need this information.

Because of the direct connection of the occiput with the sacrum, you can see that there is an involuntary participation of the sacrum in the physiologic action of the cranial mechanism. A study of the sacrum, suspended beneath the ilia, shows the resemblance to the sphenoid, suspended beneath two frontal bones. (Regarding *two* frontal bones, see the editor's note on p. 69.) The sacrum reveals in its mechanism a unity between its involuntary movement between the ilia and the movement of the sphenoid. A deeper study of the anatomy relating the ilia to the sacrum shows transverse ligaments, oblique ligaments, and no muscles. This information indicates an articular mobility that is different from the postural mobility of the ilia upon the sacrum.

> The experiments that contributed to the conclusion that the cranium and the sacrum function as a unit in a primary respiratory mechanism were not outwardly dramatic, but they were convincing and clinically valuable.[1]

I found in my experiments that I could place a little pad under the apex of the sacrum that would throw the sacrum into its flexion position (sacral base posterior and apex anterior). I could move the pad up to the sacral base and throw it into its extension position. Then, I found that if I left that pad down there I would find something occurring in the cranium that showed a connection between the sacrum and the normal fluctuation of the cerebrospinal fluid Tide. That gave me more than information. It was knowledge gained.

THE CEREBROSPINAL FLUID TIDE IN DIAGNOSIS AND TREATMENT

The next subject is the diagnosis and treatment of the cranium by way of the cerebrospinal fluid Tide. I had hesitated in mentioning this phenomenon to my associate faculty because it seemed to me to be the most uncanny thing you ever thought of. I have been calling your attention to the potency of the Tide. It has more *intelligence* and *potency* in it than any blind force that can be safely applied from the outside. The cerebrospinal fluid with that "highest known element" can work for you. When you are in doubt about the correct diagnosis, let it work for you. You can direct that Tide to an area of the skull and feel the effect against your receiving hand. If you find that it rebounds, it is bumping up against something that obstructs

1 Adah Strand Sutherland,

its fluctuation. It may rebound and rebound when there is an obstruction in a particular place. When there is no obstruction, you feel only a gentle yielding with motion. This is something that you can depend on to tell you the truth. You can use this phenomenon in treatment as well as in diagnosis. Furthermore, someone else can touch the soles of the feet while you are directing the Tide, and feel that same rebound. Interpreting the rebound of the Tide tells you something.

Suppose, for example, that you are directing the Tide from the right foot to the opposite side of the head, say to the left occipitomastoid suture. Ask the patient to dorsiflex the right foot. If the patient has a membranous articular strain in the left occipitomastoid articulation and you are in contact with the foot, you will feel a pounding like the stormy waves on a rocky shore. The Tide has backed up and you can feel it clear down on that right foot, not the left one. Do you get the point?

For another example, suppose the membranous articular strain to be in the frontosphenoidal area involving the lesser wing as well as the greater wing of the sphenoid. If the strain is located on the right, you direct the Tide from the lower side of the occiput on the left, the diagonal opposite, or perhaps from the left foot in dorsiflexion. The diagnostic rebound is specific. You do not even have to test for the pattern of mobility at the sphenobasilar junction. The Tide will tell you. It is uncanny, and that is why I have hesitated to speak of it. However, "the proof is in the pudding." Such surprises came to me. They have to come to you to manifest their reality. It is a case of learning about what you don't know. When you consider the potency of the tide out there on a rocky shore, you can ask what it is doing. It is washing away the rocky shore. You can utilize that Tide in the reduction of strains as well as in the diagnosis.

There is an illustration of working with the Tide in the case of a fifteen-year-old boy who had had six treatments from skilled physicians. When I examined him using the Tide for diagnosis, there was no rebound. Instead, there was a nice soft movement of the Tide coming into the area of strain with no rebound. It was a puzzle at first. Then it was clear that you can use this principle to tell whether your treatment is getting beneficial results. The change in the quality of response shows that change is occurring in the area of strain.

How do I direct the Tide? This is even more uncanny. You would expect that flow to go directly to some point, but it doesn't. I am not going to tell you how it gets there because I don't know, but it gets there. It seems to go right through the brain and through anything else. In other words, you direct the Tide from one point on the skull and it goes straight over to another point. How does it get there?

This Tide is directed gently by the touch of a finger. From a location on the forehead you direct it over to the occipital area, from the left frontal area to the right side of the occipital squama. You can send it from two directions down to the sphenobasilar area. You can direct the Tide from the left parietal eminence down to the right occipitomastoid suture; or, you can direct from the right parietal area, near the posterior part of the sagittal suture, down to the left petrobasilar articulation.

Another uncanny event has happened. While balancing the cranial membranous articular mechanism, another person can sit back a ways and direct the Tide to a foot without touching the foot. I know that this sounds fantastic, but I am telling you these facts from experience. Also, I have heard reports from others who have tried it out.

Compression of the fourth ventricle is directing the Tide, is it not? Bringing the fluctuation down to that short rhythmic period is the point. I have been saying something about that fluid, that Intelligent fluid, spelled with a capital *I*. Think of it. Something that nourishes nerve cells with the Breath of Life. A transmutation from that Breath of Life that runs in the nerve fiber, down to those "finer elements that dwell with the lymphatics." There is the change in the poison in the lymph nodes before the lymph is dumped back into the blood vascular system, into the subclavian vein. That is the effect when you compress the fourth ventricle. Try this procedure in cases with enlarged lymph nodes. See that change that occurs in the nodes. That is directing the Tide also.

Where is that cerebrospinal fluid? Is it only in my body? No. It is in each and every one of your bodies. There is an ocean of cerebrospinal fluid in this room. Here is a fluid within a fluid. There is a fluid within a fluid. The Breath of Life is within each. You know something about shortwave, don't you? It goes from one pole to another. It passes right through an individual. You may have tried it out with shortwave instruments by standing right between them. You don't touch a thing. You can just feel that current going right through you, can't you? Shortwave? There is shortwave between two contacts, directing the Tide. As you go about your daily life there is something that Tide is moving from — that is, moving from one individual to another. Say, from the positive pole to the negative, and so forth.

Possibilities, where are they? In Dr. Still's science of osteopathy. There were some things that Dr. Still knew but hesitated to talk about because the ground had to be prepared before the seed could be sown. Yet, he had planted the seed for the cranial concept, and it had even begun to sprout before he departed from active earth life.

You have had a little experience, perhaps, in "kicking-off" the Tide while testing for mobility. You have followed along with the Tide. Someday you will have hold of a head that will respond differently. It will turn right away from you. You can feel that sphenobasilar junction turning into another position, such as side-bending/rotation. You will not be able to hold it back. The mechanism as a whole is turning right away from you. What is doing it? The Tide.

TREATMENT

Editor's Note: The subjects of diagnosis and treatment are considered together in this chapter because Dr. Sutherland viewed the two as inseparable. In this method of treatment, a preoperative diagnosis is made and the process of treatment begins. As the patient's mechanism responds to the treatment contact and begins to change, a new diagnosis may be established.

Osteopathic technique is an intelligent application of the tactile sense and the proprioceptive sense to the search for the correct problem in the patient's body. It is not possible to acquire the diagnostic skills or the operational skills necessary for successful practice in this field through watching the other fellow's manipulations.

The osteopath is a physician who is a thinker, not a tinker. Therefore, the technique cannot be taught by the demonstration of a series of manipulations. The student can acquire such skills by working alongside an instructor. Hand-to-hand instruction is then possible as the living tissues are being studied and guided carefully, gently but firmly, and scientifically into normal relationships. Tactility is essential in treatment as well as in diagnosis. It is used in connection with the physician's comparison of the patient's mechanisms with his understanding of the normal.

There have been many ways of administering technical care by osteopaths over the years since it was first taught by Dr. Still. Some practices have crept in that are not as carefully thought out as other practices. The name for some of these ways has become manipulation rather than technique. There is a difference. What is it? Some physicians place a patient on the table, grab hold of the head with the frontal-occipital contact, turn it around, and give a yank. Is there any science in that? Dr. Still said that he was teaching his students to think before they act. If you do not know the mechanism before you make a diagnosis and plan a treatment procedure, you are not practicing osteopathy. Stop to think of the possible strain you may be putting on ligamentous tissues that hold articulations together and allow a normal range of movement.

I am trying to bring out the importance of the application of the manual contact, especially in the techniques related to the living human cranium. If you try to push with your thumb in temporal technique, or if you push with your fingers on the vault you are not going to know what those thinking, feeling, seeing, knowing muscles can do. Always be aware of the possible forces you may be introducing into the patient's mechanisms. Know what you intend to do and know what you have done. Keep track of your own weight. Use your weight precisely. Do not allow your weight or any other force to enter the patient's body accidently. Recognize what is going on in the patient when the operator pushes, pulls, or manipulates. How is the operator aware of the patient's tissues? Ask the scientific question, "What is going on here?"

The mechanism of the forearm, wrist, and hand is a good example when considering the principles of the better way of practicing that Dr. Still taught. The muscle that moves the tendons that are attached to the distal phalanges of the fingers is the flexor digitorum profundus, which lies on the flexor surface of the radioulnar interosseous membrane. If there is a membranous articular strain of that interosseous membrane, the mechanism that operates that muscle — the tendons, wrist, and hand — will have a problem. The operator who understands that mechanism is in a position to find the correct problem. Then he can devise an appropriate technique for helping the patient's mechanism solve its problem. This principle is reliable for addressing the particular problems that different patients bring to you.

You can also use your knowledge of the flexor digitorum profundus in developing your skill in managing the diagnosis and treatment of the temporal bones. Using this muscle together with the flexor pollicis longus in the management of your manual contacts enables you to feel the delicate mechanisms of the cranial structures and to sense the state of balanced ligamentous tension in the synovial joints of the spine.

Management of the Cerebrospinal Fluid Fluctuation

As you place your thumbs and thenar eminences along the mastoid portions and processes of the temporal bones, take care to avoid compressing either the occipitomastoid sutures or the temporal bones as a whole by balancing your hands on your crossed fingers beneath the neck. As you observe positions and test for motions, you will gain information about the petrous portions and the occiput. In that state of manual balance you allow the bones to move your hands or to manifest a limitation of movement. Your information is reliable because you have not interfered with the actual state of conditions.

Starting from this contact with the temporal bones, the operator is able to develop several skills for special purposes. One frequently uses the temporal bones for techniques that manage the fluctuation of the cerebrospinal fluid.[2] When managing the fluctuation of the cerebrospinal fluid you are seeking a rhythmic balance. Picture the rotation of the petrous portions of the temporal bones. See that tentorium cerebelli attached to their superior borders. That is what I have called the lateral poles of attachment of the reciprocal tension membrane of the cranium in my schematic description of that part of the primary respiratory mechanism.

You all know that tool the carpenters use, the level. The level has places where fluid is enclosed that changes when the tool is moved. The fluid moves back and forth as the carpenter moves

2 For a general discussion of these techniques see "Altering the Pattern of Fluid Fluctuation" in:

the level. When you know your mechanism, you, as an operator, can move the fluid within the cranium by your contacts on the outside of the temporal bones or on the occipital squama. It moves like the Tide in the ocean. This fluctuation of the cerebrospinal fluid is a fundamental principle in the primary respiratory mechanism that you can use to control that Tide. That is why I have said that the cerebrospinal fluid is in command.

When you read and interpret what your hands tell you through your contacts on the bones, you can perceive the movement of the Tide and the punctuation, the accent, of the movement. You can feel the strains at the bones and joints. When there is resistance you can feel the waves pounding upon the "rocky shore." It is not a stretch of the membrane there. It is an automatic shifting of the fulcrum of the mechanism. It is the fulcrum point that you must visualize in your technique. You read the accents, the punctuation, through the fulcrum area. Recall what I have said about the fluctuation of the cerebrospinal fluid. This is a motion contained within a natural cavity — that is, the cranial articular mechanism, and also within the chambers of the brain, with open doorways. The fluid is surrounding the brain within and without, and all within the osseous walls, which have the external layer of dura mater as periosteum.

I want you to see the situation in which you have established a lateral fluctuation of the cerebrospinal fluid and brought it down to a balance point, a midway point, between inhalation and exhalation. Then you have the brief period where the patient's diaphragm is merely moving gently about a fulcrum point. That is when you get this fine vibration at the center of the Tide. It is the stillness of the Tide, not the stormy waves that bound upon the shore, that is the aim of the technique. As a mechanic of the human body in understanding the mechanical principle in this fluctuation of the Tide, you are in contact with the potency, the power, to treat and resolve problems.

Consider the different movements of the tides: the groundswell of the ocean on the continental shelves, the different wave and current forms, and the way the tide behaves in different tidal basins. See a sort of spiral movement in connection with the movements of the brain. See the spiral coil moving out one way and then coming together. How many spiral movements can you visualize in that Tide? How many little coils can you see?

I have walked along a quiet shore with lots of seaweed floating out in the water. I have watched this seaweed moving in rhythmic patterns with the groundswell, with the tide. Some were spiralling in one direction and some were spiralling in the other. For a large pattern, see the hurricane; see the potency in the eye of the hurricane, not the destruction around the outside. See the stillness at the center and the spiral movement. Like the pilot on the ferry that crosses San Francisco Bay, you can get on the balance point and let the potency carry you along. (For the description of the ferry's operation, see p. 32.)

* * *

There are a variety of ways in which the management of the cerebrospinal fluid can be approached. I have used the terms "cat's paw" and "pussyfoot" to make the point of different degrees of excursion and different rates in turning the petrous portions of the temporal bones for controlling the fluctuations. When you want to incite an alternate lateral fluctuation of the cerebrospinal fluid, you may think of "Father Tom," a cat who gets excited up on a fence with another tomcat nearby. When I think of "Mother Puss" gently purring to her kittens, I visualize a smaller, more rapid excursion that approaches a still point. These allusions consider the difference between an excitative treatment and a palliative treatment. With the incitation from "Father Tom" you urge to action the fluctuation, and with the palliation of "Mother Puss" you manage that fluctuation so as to bring it to the still point.

A variation of activating the fluctuation of the cerebrospinal fluid from side to side with alternating control on the temporal bones is to turn them differently at the same time. That is, you turn one temporal bone into external rotation at the same time that you turn the other into internal rotation. The aim of activating or inciting techniques is the establishment of a fluctuation within the cranium from side to side. When you can observe this effect you can then control the action so as to bring it down to a still point.

When you are using this result for palliation or quieting, you allow your hands to move so gently that the turning is barely perceptible. In fact, you may think that you are not doing anything. As the patient's head rests in your hands, the temporal bones move simply because they are cradled within your grasp and the patient is breathing. You are using your motive power on your hands, not on the patient's head. Your hands move around the fulcrum of your crossed fingers in a very short excursion. This is why it is called a palliative application.

The physiologic response is to be the same as when you compress the fourth ventricle by springing the occipital squama, the supraocciput, medially and holding it so that the shape of the posterior cranial fossa has changed. This change brings the cerebellum down upon the roof of the fourth ventricle and the pons up, reducing the size of the ventricle. As the cerebrospinal fluid is not compressible, the operation moves the fluid, that is, displaces it.

I want you to think about what is happening when you perform these operations for managing the fluctuation of the cerebrospinal fluid. When that short period is vibrating, sense it as a rhythmic balance in the fluid. This is the point of change. It seems like a state close to suspended animation. That is why the work of the operator is completed when this aim is accomplished. After the still point, the patient's body carries on the work. You may watch how it does so, but your treatment is over.

You have brought the body of cerebrospinal fluid to a condition where the whole — all around the brain, within the brain, all around the spinal cord, and within the spinal cord — is simply quivering or vibrating. In the still point that arises from the application of these techniques, the motor is idling and there is an interchange between all the fluids of the body.

Something goes out from that quiver; a change, or transmutation, occurs in that fluid, an invisible something. It is not an outflow over the nerves, although the change follows along to the area where the terminals of the peripheral nervous system dwell with the lymphatics. The change is in the constituents, or elements, through transmutation. This is quite different from transmission, or outflow.

I want you to see that "highest known element" in the human body going out in that transmutation from the nerve cell along the fibers to the terminals. Then, perhaps, you will grasp more clearly what Dr. Still meant when he said that the lymphatics consume more of the waters of the brain than the entire viscera.

> The lymphatics are closely and universally connected with the spinal cord and all other nerves, and all drink from the waters of the brain.[3]

I am making a special effort to stress the point that I consider the fluctuation of the cerebrospinal fluid to be the *fundamental principle* in the cranial concept. The "sap in the tree" is something that contains the Breath of Life, not the breath of air — something invisible. Dr. Still referred to it as one of the highest known elements in the human body, replenished from time to time. Do you think we will ever know from whence it cometh? Probably not. But it is there. That is all we need to know.

In using the direction of the Tide for correction, for treatment, you use the same direction process that you used for diagnosis. You direct the Tide from the diagonally opposite area

3 Still, *Philosophy and Mechanical Principles of Osteopathy*, p. 66.

that you are examining. If you did nothing other than direct that Tide, there would be, in time, a correction of the lesion.

* * *

Here is another thing you can do for treatment. Take the temporal bone, for example, and the occipital bone; visualizing the movement at the occipitomastoid articulation, turn the temporal bone very gently in one direction and the occiput in the other. Hold this situation gently while you direct the Tide from the diagonally opposite frontal area. There will be some surprising experiences to observe under your gentle, feeling, seeing, thinking, knowing fingers. You are going to be dealing with many varieties of trauma in your practice. That is why I am stressing this direction of the potency of the fluctuation of the cerebrospinal fluid in diagnosis and in the techniques of treatment.

* * *

You are to learn to perform what I call activation or incitation of the fluctuation of the cerebrospinal fluid. This deliberate operation is appropriate only in an emergency situation. Such situations do not arise often, but when they have and a skilled osteopath has been present, this operation has been successful in starting the physiologic fluctuation of the cerebrospinal fluid within its natural cavity. I have received several reports to that effect. This operation is performed by turning the petrous portions of the temporal bones in the same direction — that is, into external rotation, at the same time that you turn the occiput into flexion. This is a difficult manual effort, and under emergency conditions it is awkward. It is another way of using the tentorium cerebelli to control the fluctuation of the cerebrospinal fluid. (For another description of this technique see p. 36).

Place the thumbs and thenar eminences along the mastoid portions and processes of the temporal bones. Interlace the fingers loosely beneath the neck. The crossed fingers serve as a fulcrum for the action of the thenar eminences and the thumbs. Then, while turning the occiput into flexion with the sides of the hands, turn both petrous portions into external rotation using the thumbs and thenar eminences. This throws the cranial base into its flexion position. Allow the mechanism to return to neutral for a bit and then repeat the operation of inducing flexion.

Treatment of the Occipitoatlantal Joint

In instances of a ligamentous articular strain at the occipitoatlantal joint, a mere extension or flexion of the occiput on the atlas will not accomplish results. This is because in the habitual lesion we find that the facets of the atlas move forward with the occipital condyles. It is necessary to *hold* the atlas while the occiput turns — that is, to hold the bolt while the nut is turned. A method of drawing the tissues together, of approximation with tactility, is preferable to trying to pull them apart.

You will not be able to feel the condyles directly, for, like the surgeon with his probe, the movement of the condyles is detected through the trained tactile sense. The difference in the movement of the joint when it is back to normal is particularly noteworthy. Feeling and seeing the tissue as you move it is that skillful act known as osteopathic technique when applied to osseous malalignments.

This important joint is a ligamentous articular mechanism, a synovial joint. Understand that joint when the patient inhales and exhales. Note the swivel joint that comes into play. The occiput moves on the atlas when nodding. Otherwise the occiput and atlas move together on the axis in a wide range of rotation. The atlantoaxial ligaments, the tectorial membrane, and the intraspinal dura mater all come into play.

It is a simple matter to place your index or middle finger beneath the occipital bone, near the opisthion, *not* on the arch of the atlas. It is convenient to start at the inion and follow the midline on the supraocciput toward this point on the posterior rim of the foramen magnum. That is as near as you can get to the posterior tubercle on the posterior arch of the atlas without going too far. Then, ask the patient to nod his head without flexing his neck, as the occipitoatlantal joint is a nodding articulation.

The easy part of this technique is simply holding the atlas when the posterior tubercle comes up to your finger tip as the patient nods his head. As the atlas is stabilized, the condyles on the occiput can move into the divergences of the facets of the atlas. The respiratory cooperation automatically assists in lifting the condyles and thus realigning the relationship. The operator then notes the change in the motion of the articulation. There is no contraindication to repeating this technique when compression of the condylar parts of the occiput occurs, even during the course of a single treatment. (For another description of this technique see p. 112.)

Treatment at the Bedside

Those patients confined to bed for any reason should be treated with delicacy in the application of an anatomicophysiologic touch. With the patient lying on a side in the flexion position, as though in a hammock, the force of gravity can be focused to draw the vertebral column posteriorly. This is to relax the ventral tissues of the spine. This posture of general flexion is a benefit in countering the drags that occur in the vertical posture during a day's work. When applied to the patient in bed, the relaxation of tissues ventral to the spinal axis also relaxes those dorsal to it. It is therefore unnecessary to use methods aimed to "break up" contractions and rigidities.

Administering osteopathic services to patients confined to bed with acute ailments requires specific skill in feeling the tissues and interpreting the information. The special goal of relaxing the anterior spinal ligaments and other tissues ventral to the vertebral column so as to insure a normal blood supply and functional lymph channels in relation to the spinal cord should be kept in mind as one proceeds. It is important to prevent the disturbing reflex influences through the sympathetic ganglia. This procedure is also useful in releasing the diaphragm to a free excursion.

It is especially important to address problems that may limit the excursion of the diaphragm when there are secondary complications in the original illness. Respiratory illness is often susceptible to complications. The key to a drag on the diaphragm may be in the posterior abdominal wall. Increased tensity of the lumbocostal arches, or arcuate ligaments, may require treatment.

The crura of the diaphragm are attached to the anterior longitudinal spinal ligament at the level of the first and second lumbar vertebrae and also to the third lumbar vertebra on the right. (See Figure 18.) They cross over the aorta and the receptaculum chyli in the midline. From the side there are two fascial structures, called ligaments, that pass over the quadratus muscle and the psoas major muscle. These lumbocostal arches are fastened to the twelfth ribs, the transverse processes, and blend into the crura of the diaphragm. This area of the posterior abdominal wall is usually taken for granted, but the normal action here has work to do. If it is not working, there are benefits to the patient in releasing the increased tensity.

One way of doing this, with the patient supine, is to use the twelfth rib as a contact. Carry this rib into a state of lateral traction and hold. The patient may provide postural cooperation as well as the natural respiratory cooperation. This may take the form of positioning or of moving as circumstances indicate.

I have had occasion to note that riding horseback in a saddle may accomplish the reduction of sacroiliac strains to the normal. (This story is told on p. 204.) On occasions I have found it useful to imitate the mechanics of that action. As analyzed, I see that the sacrum may be balanced and reseated between the ilia if the ilia are moved laterally. In the saddle the sides of the horse hold the femurs laterally as the saddle rhythmically moves the sacrum between them. At the bedside the operator can carry or turn the ilia laterally but he may need to have a nurse turn the sacrum.

The charter of the American School of Osteopathy, the first osteopathic school, stated that its purpose was to teach methods for improving the practice of surgery, obstetrics, and the treatment of diseases generally. Do you realize the full meaning of that? You have that improvement because your skill is nonincisive through the use of thinking, seeing, feeling, knowing fingers. You are nonincisive surgeons.

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FOURTEEN

Clinical Experience in the Practice of Osteopathy

When I went out into the field to practice, I had nothing. When I met up with some of those old dried-up chronic cases, all I had to work with was the *science of osteopathy*. All I had to compete with the medical profession and their equipment then in use was what I had been taught at the American School of Osteopathy. I did succeed and began to find improvement in some of those old chronic cases. That is why I have said, "If one can *think osteopathy* one will find much in it. Don't twiddle away with something else. Keep on digging and digging until you have found the correct problem." If you do keep on digging you will find the Old Doctor's "squirrel in the hole in the tree." I think of this cranial concept as merely a "breech presentation" of that squirrel.

The word *osteopathy* has been ridiculed as a misnomer. Those who take that view lack perception of Dr. Still's thinking and are not informed of the truths in his teaching. When Dr. Still named the concept that he had decided to practice "osteopathy," he said that he chose the name because "you begin with the bones." He considered this decision the birthday of osteopathy. That was June 22, 1874.

Experience with Managing the Fluid Mechanisms

Consider the soft tissues and the fluids of the body. For instance, in cases of fractured bones the use of the principle of management of the fluctuation of the cerebrospinal fluid is important in the care of the case. I use the lateral fluctuation of the cerebrospinal fluid to reduce edema before immobilization, such as a cast, is applied. It helps in the chemistry of clearing out the debris around the fracture and in promoting the formation of a callus. If you reduce the edema after the cast is applied, you may find that the cast is ready to drop off in a day or two. All ways of bringing the fluctuation of the cerebrospinal fluid to a still point can be used for promoting muscular relaxation and reducing acidosis in the muscles. Normal body chemistry tends to become restored.

Management of the fluctuation of the cerebrospinal fluid is useful in problem conditions in the viscera. It has a definite effect on the liver, spleen, and pancreas. It helps to increase the efficiency of the immune response of the body. The patient immunizes himself against an infection already in the body. In acute conditions, in circulatory conditions, edema is reduced, congestion subsides, and the blood supply to places where it is needed is improved. If a person has a deficiency in circulation to some part and you want to improve it, use compression of the fourth ventricle. That procedure acts on those vasomotor centers. With respiratory illnesses in the past I have used Miller's lymphatic pump. (See the editor's note on p. 138.) However, with compression of the fourth ventricle I have a method that is more simple and effective because I am working on the fundamental control mechanism. I am letting the patient's body do its own regulating as needed.

Just think of the value of a method for affecting the function of the parturition center in the medulla. It is a simple technique for accomplishing a great purpose — that is, for overcoming uterine inertia and smoothing the process of delivery. Some of the other physiologic centers in the floor of the fourth ventricle are a cardiac inhibitor and a cardiac accelerator for the management of the balance in the action of the heart. The inhibitory control is carried out by the parasympathetic pathway: the vagus nerve. The acceleration is carried out by the sympathetic nervous system. Note that the vagus nerves leave the cranium through the jugular foramina along with the ninth and the eleventh nerves and the internal jugular veins. Recall that the jugular foramina are formed by the relations between the two temporal bones and the occiput. If these are strained, there will obviously be changes in the size and shape of the jugular foramina. Entrapment neuropathy could result.

Additional physiologic centers in the floor of the fourth ventricle are a sweating center; a heat control center; the respiratory center; controls for the functions of sneezing and coughing; and centers for regulating salivation, vomiting, blood glucose, and the digestive tract. Note that the nuclei of the eighth nerves lie in the brain stem and that the cerebellum lies above the roof of the fourth ventricle. Thus, the functions of hearing and control of equilibrium and posture are centered in this region.

What more can an osteopath ask for when he can make contacts on the outside of a region with as much regulating power located on the inside? When there is a clinical problem to be treated, he has only to use his knowledge of the functions related to the medulla oblongata, the pons, and the cerebellum. With his operating skills for managing the fluctuation of the cerebrospinal fluid in the posterior cranial fossa he has the reins right there in his hands.

I want to call your attention to the benefits of managing the fluctuation of the cerebrospinal fluid when treating chronic lesions in the spinal column. I call it "penetrating oil" for use on old rusty joints. The mechanic who is dealing with an old rusty nut and bolt will not take a wrench and turn it. He first applies a drop or two of penetrating oil, which spreads out along the threads. When it has had time to work, he takes only his fingers to turn the nut and the bolt and does not injure either the threads of the nut or the bolt. By bringing the Tide down to that short rhythmic period and to that important interchange between all the fluids of the body, you can lubricate those chronic situations gradually so that they return to normal functional conditions. Fibrosis also fades out, and normal muscle tissue reappears in due time.

You can study the Tide from the sacrum when you have a case suggesting an impending stroke, or an acute head injury, or a possible skull fracture. [These are instances where it is not considered safe to directly treat the cranium. –Ed.] Using the sacrum, bring the fluctuation of the Tide down to that short rhythmic period and provide a chance for rest. In *Rest and Pain*, Hilton writes:

> I venture to think that the considerations applicable to external injury ought to indicate the principles of treatment to be adopted in case of concussion of the brain. No doubt our duty should lie in this: to give the brain absolute rest; to rely on . . . Nature's power to repair the injury or disturbance; to avoid stimulants, which excite quick reaction and have a great tendency to do mischief . . .[1]

Experience with Ligamentous Articular Mechanisms

When I was a member of the first House of Delegates to the American Osteopathic Association in 1920, I had little time outside the meeting room, but I took every opportunity to visit the room of H. Virgil Halladay, D.O., who was a professor of anatomy at the American School of Osteopathy in Kirksville, Missouri. He had written a little book entitled *The Applied Anatomy of the Spine* based on the special anatomical model that

1 This work originally appeared in 1863. John Hilton, *Rest and Pain*, ed. E.W. Walls, Elliot E. Philipp, and H.J.B. Atkins (London: J.B. Lippincott Company, 1950), p. 52.

2 Virgil Halladay, *The Applied Anatomy of the Spine* (Kirksville, MO: Journal Printing Company, 1920).

he brought to the convention.[2] The model consisted of all the bones of the pelvis, spine, and rib cage, which were held together by ligaments that had been treated to remain resilient and functional. All the musculature had been removed.

While I studied the model I would spring the ischia and study the way in which the sacroiliac joints operated. When I brought the tuberosities together, the ilia moved out at the upper area. When I spread the tuberosities, the ilia came together at the upper area. I saw that the ligaments held the pelvis together and also regulated the range of motion in the area.

From the study of the ligamentous articular mechanism of the pelvis I learned enough so that I could compete with the needle and with the methods of ambulant proctology in my own profession. What happens when you crowd the tissues in the true pelvis? What happens when people have sit-down falls and the ascending colon or the sigmoid colon get locked down into the pelvis? Do you see a drag on the fascia? Or a difficulty with venous return from the pelvic veins? Or a strain in the pelvic diaphragm with a background developing for hemorrhoids, a sagging uterus, or an enlarging prostate? *Thinking osteopathy* with Dr. Still and with this view of anatomy, I developed several methods that I called "lap technique." I would sit down by the table and have the patient sit on my knees. All I had to do was to draw the ischia together or spread them apart according to the type of situation in the pelvis. It is simple, but in order to be a good mechanic you must know something about the mechanism.

It was about this time that the osteopathic profession became interested in problems of the feet. Many devised techniques for the foot mechanism. If you can successfully diagnose and treat the problems of painful feet, you have come to some understanding of the mechanism of the living human foot.

I have seen operators attacking the external cuneiform bone, trying to jerk it into place when it had dropped or trying to pull it out with the toes. If, instead, you understand the mechanism and the location of that external cuneiform in the mechanism, you can just go right into the area and feel when you get the balance point. All you have to do is to remember that the ligaments allow a certain range of movement. It is easy to let them realign the relations of the bones. You can also realize the function of that little talocalcaneal interosseous ligament and see that you can use it for realigning the relations between the talus and the calcaneus.

The leg is a membranous articular mechanism. So is the forearm. There is the tibiofibular interosseous membrane and the radioulnar interosseous membrane. You can use these membranes as you use ligaments to realign the relations between the bones. This is because they function like ligaments in the regional mechanisms.

Dr. Still gave me a lesson one day along with the rest of our class. A member of the class had stepped on a rusty nail. All the appropriate surgical management and cleansing had been used, but the wound would not heal. It began to look an angry red, so we called in the Old Doctor. He said, "You damn fools!" And we were. We had not stopped to consider that when the patient stepped on that nail he drew his leg up away from it. What happened? The little fibular joint at the proximal end went posterior and the joint at the distal end went the other way. Thus the blood supply down in the foot was disturbed, and that was where the rusty nail had done its mischief. The lasting problem was not the nail or the original wound; it was what occurred in that sudden jerk of the patient that caused a membranous articular strain between the fibula and the tibia. It was a strain at both ends that also strained the interosseous membrane between them.

You can take both ends of the fibula and balance the two bones through the action of the tibiofibular interosseous membrane. The radioulnar interosseous membrane will also work for you when you balance the mechanism with two contacts. You can do the same with the clavicle, which has two articular points. The clavicle may be tipped in at the sternal end and out at the acromial end or vice versa. With the patient sitting, all you have to do is to get a thumb under each end of the clavicle, ask the patient to bend forward and thus lift both ends. The ligaments do the balancing. This is why I treat fibular lesions with a contact at both ends. It is a double lesion that may also happen in the forearm. The radius and the ulna together make a double swivel. When both ends are strained the interosseous membrane is not only also strained but it is the agent that will resolve the strain with two contacts. (For descriptions and illustrations of these techniques, see the Appendix.)

When a patient complains of discomfort where the deltoid muscle inserts, look to the origin of the muscle both on the clavicle and on the scapula. See that type of lesion twisting the tendon of the muscle rather than an irritation to the circumflex nerve. See the twist in the muscle itself and a change in the distance from the origin to the insertion.

Nut and Bolt Principle

There is a mechanical principle that I have found especially useful when dealing with the articular relations between the vertebrae and the heads of the ribs. It is the principle of the nut and the bolt. What is more simple than fitting the nut upon the bolt or turning the bolt into the nut? Often, the patient himself is the nut. That is, when the patient gives you his postural cooperation you, the operator, can hold the bolt while the patient turns the nut. Ribs, for instance, are bones which are easy to contact, and they can be held.

On some vertebrae there are two facets for ribs. What are we looking at when we consider the ribs? Do we look at the angles? If so, that is not helpful. The articular action of rotation is at the head of the rib in the facet of the vertebra. The head of the rib is often forward in association with a so-called anterior spinal lesion. When you try to get it back you may find that you cannot move that rib.

If you hold the spine and ask the patient to turn away, you are holding the nut and the patient is turning the bolt, the head of the rib. Or, you can hold the rib and have the patient turn the vertebrae. Either way, you and the patient engage the ligaments in moving the bones so that they go into their normal relationship of their own accord. (For a fuller description of this treatment, see the Appendix.)

With the influence of the sympathetic nervous system, through the lateral chain ganglia, responsive to correction of strains between the vertebrae and the ribs, the osteopath has no lack of things to do to help the patient's body restore normal living processes.

FIFTEEN

Osteopathy in General Practice: Some General Techniques

Direct visualization of inanimate specimens in the anatomical laboratory can teach us a great deal. However, when it comes to considering the animate specimen in our work, it is necessary to stretch the imagination. We work as osteopaths with the traditional principle in mind that the tendency in the patient's body is always toward the normal. The self-regulating, self-correcting, self-healing processes are usually going to be successful. That is why we want to get our perfect, precise knowledge based on the perfect, animate specimen into our thinking. We need that to provide ourselves with a clear picture of the normal, especially the picture of the intracranial and intraspinal mechanisms.

What usually goes wrong is either too much or too little of what is going on in the normal. Many patients have knowledge of the human body and its mechanical principles. They know whether you understand the mechanism or not, especially when they have a problem that hurts. They come to you when they have a problem and they cannot get at it and it does not go away with rest and time. There is much to discover in the science of osteopathy by working with the forces within that bring out the healing processes. It is better to work with these forces than to apply something from the outside.

The patient's breathing is always going on and will cooperate with you when you establish a state of balance in the function of ligaments, membranes, and fascias. You can add postural cooperation and let the patient do the work of making the corrections for you.

Do not pass over the old chronic areas that have been static and immobilized in fibrosis. Feel the story that the tissues can tell you and get the relevant history as you can. Patients tend to remember the pertinent events after you have been working with an old problem. Organize and understand the details in the story as the patient tells it in relation to your findings in the structural examination so that you have an interpretation that gives you a working diagnosis. Then you have a scientific basis for your plan of treatment. With this you also have a basis for a prognosis.

At each visit you can evaluate what has been going on in the patient's problem area and what has not been going on. You realize that you are a mechanic of the fluids of the body as well as of the osseous tissues, which are also fluid. You have become the pharmacist because your procedures have been mixing the chemicals in "God's drug store," as Dr. Still called it. We need to get back to the *science of osteopathy*. We can't go anywhere else. We have great possibilities in our work for suffering humanity. I say possibilities because we are not performing miracles.

You can be surgeons, bloodless surgeons, in your approach to certain problems. It is an art, the art of practicing with Dr. Still's science of osteopathy. When you find a fascial mechanism dragging when it should be lifting, study what has happened above as well as below. The ventral fascias are attached to the spine above the area where they function. If you find a lesion between the heads of the ribs and their vertebral facets, you may find a very old lock. It is often found in the upper thorax. The most effective program for change is a series of treatments with patient cooperation and the use of "penetrating oil." Such a series of visits is not to be compared with repetitive soft tissue mauling that attacks only an effect, the effect of chronic muscle contraction or contracture. A forceful "breaking up" of the protective muscle contraction and fibrosis is not going to be of lasting benefit because it does not allow time for the reversal of the process.

Take the anterior and posterior longitudinal spinal ligaments that run from the basilar process of the occiput to the sacrum and connect the vertebral bodies and intervertebral discs into a segmented flexible rod. Then see the articulations in the neural arches that limit the excursion of the movement between the bodies. See the muscular agencies of the back, which move the spine and regulate its range of motion. See also that these muscles protect the joints.

Note the functions of the rib cage in bracing the spine, in forming the thoracic cavity for the heart and lungs. See the crura of the diaphragm attached to the anterior longitudinal spinal ligament, moving the vertebral column with every breath when you are asleep and when you are awake. I am trying to get you all to *think osteopathy* and see that part that is the postural and voluntary secondary mobility, as well as the part that is involuntary and primary.

We have found in our *thinking osteopathy* that there is involuntary mobility in the pelvis that connects up with the involuntary mobility in the cranium. In the pelvis we find that there are no muscular attachments running from the sacrum to the ilia. We do find the muscular attachment from the sacrum to the trochanter of the femur, and beneath that the sciatic nerve. We also have postural mobility through the muscular system.

ACHIEVING BALANCED LIGAMENTOUS TENSION

Editor's Note: Dr. Sutherland's approach to the treatment of areas other than the cranium was referred to as "general technique." Dr. Howard Lippincott wrote an article describing some of these techniques and illustrated it with photographs he took of Dr. Sutherland demonstrating them. This article is included as an appendix to this book. Many of the techniques described in the remainder of this chapter are referenced to the Appendix.

The Pelvis: Lap Technique

I have found the ischia too close together in all cases of enlarged prostate glands when I have examined the pelvis. I have used the procedures that I call lap technique for treatment under these conditions. What you do is to have the patient sit down on a lap pad across your knees. Then you spread your knees. If you wish to do more in balancing the ligamentous articular mechanism of the pelvic bowl using the lap technique you can simply raise the heel of the side on which you decide to control the innominate (pelvic) bone. You can, in fact, control both innominate bones that way combined with the spreading or approximating of your knees. You can raise both heels, only a bit, and tilt the pelvis. Your hands are free for use in making other contacts. (See Appendix and Figures A.12-14.)

When the patient is seated on the lap pad over your knees, you ask for cooperation. The patient puts his hands on the table while you manage the pelvis with your knees and hands. By raising a heel a bit you move that side of the pelvis up, and by moving a knee laterally or medially you can control positions. Your hands are free to guide in addition to this influence from below. When you ask the patient to place his elbows on the table you can observe the contours of his spine and further ask him to walk away from you with his elbows. This combination of the patient walking across the table on his elbows as the operator holds the innominate bones back is one way to lift the sacrum cephalad. It is helpful in cases of psoas spasm in adults and with children. With infants the principle can be used right on the table. In fact, there are many combinations that are practical in the use of the lap technique for establishing balanced ligamentous tension. Corrections are made with the guidance of the operator and active cooperation of the patient.

The Lower Extremity

You can use the principle of the fulcrum and postural cooperation in treating tibial or fibular lesions at the knee. (See Appendix and Figures A.34-35.) The patient places the problem leg over the opposite knee. The fulcrum is located where the leg is placed. The operator is seated in front of the patient at a slightly lower level. He can grasp the proximal end of the fibula with one hand and the distal end with the other. Then, the patient places his hands, one over the other, upon the knee and pushes it toward the floor as he dorsiflexes the foot. The combined maneuver in action operates over the fulcrum so as to rebalance the tibial, fibular, and femoral relations.

In a similar way, you can combine the cooperation of the patient with the creation of a fulcrum in treating a ligamentous articular strain at the hip joint. (See Appendix and Figures A.32-33.) The patient is seated on the table with the operator seated in front of him. The operator creates the fulcrum by placing his opened hand as near as possible to the joint on the medial side of the patient's thigh. The patient places his leg upon the other thigh and his hands on the top of that knee. Then he leans forward, and falls to the side and backward in a circular motion, coming forward again as the operator leans his weight into his contact on the inner thigh near to the hip joint. Or the patient may move around his femur in the other direction, depending upon whether the strain was in internal or external rotation. This is another use of the principle of the bolt and the nut. You are holding the bolt (the femur) and the patient is turning the nut (the acetabulum). I learned this procedure from the Old Doctor. He knew the anatomicophysiologic mechanics so well that he could put a patient up against a tree or anywhere he met him and skillfully correct the particular problem because he knew the mechanism.

The Upper Extremity

The forearm is a membranous articular mechanism with two swivel joints. The proximal radioulnar articulation allows the proximal head of the radius to turn at the same time that the distal joint turns in pronation and supination. When there is a membranous articular strain of this mechanism, you sit down and have your patient sit down in front of you. Take a hold with the thumb and forefingers on the head of the radius at the proximal joint. Take another hold on the radius at the distal end. Then suspend the forearm by these two holds and allow the radioulnar interosseous membrane to restore normal relations. Alternatively, take a hold on the radius proximally and a hold on the ulna distally so that you can establish a state of balance between them. (See Appendix and Figure A.24.) Then have the patient bend the elbow up and down while you hold the balance. Let the patient do it. It is much more scientific than tinkering with a yank.

Have your patient turn the elbow into pronation and supination, back and forth, and see how easy it is to correct some of these radial lesions. Tenosynovitis, or tennis elbow, is a case in point. It is not one lesion, it is a double lesion clear down to the distal articulation. You can recognize a lesion at the elbow between the olecranon process of the ulna and the humerus. When the elbow is flexed the coronoid process fits into the coronoid fossa. When the arm is extended the olecranon process fits into the olecranon fossa. Therefore, if the ulna is to be released in relation to the humerus, it should be placed at a right angle at the elbow.

The next time you find one of those troublesome situations where the patient cannot flex or extend the elbow very far, try finding that point where you can just pull the ulna down and let the ligaments draw the ulna back into place. (See Appendix and Figure A.23.) The ligaments will do that for you. You need to understand the mechanism in order to understand the problem and operate on it with its own mechanical possibilities. If you bring the ulna up to a right angle, you can contact the process at a place where, at a certain point, you simply pull it out into position. With the olecranon process in its fossa you cannot realign the parts.

Use the same principle for a problem at the other end of the humerus, in the action of the shoulder joint. All you have to do is understand the mechanism of using a fulcrum under the humerus. Make a fulcrum by placing your hand close to the joint between the inner arm and the side of the chest. Have your patient place his hand on the other shoulder, which draws the arm over the fulcrum. He can raise or lower his elbow slowly. This will permit you to find a position of balanced ligamentous tension in the shoulder joint, and the ligaments will do the work.

The Clavicle

As mentioned previously, the clavicle is a bone that has an articulation at both ends. There is one at the sternal end and another at the acromial end. The coracoclavicular ligament serves as a fulcrum when you place a thumb under the clavicle at each end and push up by leaning your weight into your thumbs as the patient leans forward from the seated position. Thus the weight of both patient and operator is balanced with the clavicle around the fulcrum. The patient moves the opposite shoulder backward, thus drawing the sternum away. The natural breathing provides sufficient respiratory cooperation. Shortly, the clavicle is released and realigned with the sternum and the scapula. (See Appendix and Figure A.18.)

The operator makes a preoperative and a postoperative diagnosis by observing the landmarks at the sternal ends of both clavicles for comparison. Correction of malpositions of the clavicle in terms of all three dimensions occurs with this operation. In cases of greenstick fractures of the clavicle in young people, the bone may straighten out as the operator's weight leans into his thumbs located at both ends. Obviously, the proper orthopedic procedures for maintaining the reduction should be carried out.

The Thorax: Ribs

Upper ribs often become strained when a person is lifting or overreaching while in a posture with their arms raised above shoulder height. This occurs when standing or stooping. The strain is commonly found with the ribs in an upward and backward position. This causes traction on the serratus anterior muscle that acts on the rib or ribs. The muscle may need attention before the problem of the rib is addressed. There is apt to be a muscular contraction beneath the scapula, which tends to hold the rib or ribs in malposition. (See Appendix and Figures A.7-10.)

The operator can use a sitting or standing posture technique here to advantage. Approaching from the front, the operator places the fingers of one hand carefully and gently beneath the scapula below the shoulder. His fingers go as far back as possible and fixate the rib or ribs involved. His other hand is placed over the acromioclavicular articulation. The patient is then instructed to lean toward the operator and turn the opposite shoulder forward and then backward while the operator guides the action with attention to what is happening at the vertebral facets.

The contraction in the fibers of the serratus anterior is usually encountered by the operator as his subscapular contact travels backward beneath the scapula. This condition should be released by springing the scapula outward before making the rib reduction. Lower rib lesions may be handled nicely with the patient standing or sitting in the vertical posture.

To avoid this type of strain, instruct people to avoid overextending by working with their arms no higher than the level of the shoulders. The elbows can be bent to allow work to be done overhead. If this position does not allow for the task to be done, then they should change the place where they stand.

Standing Posture Technique: Pelvis, Spine, Viscera

Editor's Note: This section is adapted from the writings of Dr. Sutherland.[1]

Many low-back, mid-back, and high-back strains occur while in the standing or stooping position. A technique for reduction of these with a minimum of energy and a maximum effect is indicated. Such a technique can be arranged with the patient standing. Low-back lesions sustained while standing or stooping are not true sacroiliac lesions or spinal strains. The patient in this predicament usually hobbles into the office with the help of a cane. His posture is an exaggerated stoop with side-bending/rotation of the trunk. He points to the low-back and speaks of pain in the lumbar region and the sacroiliac joint.

These are secondary indications of a primary femoroacetabular lesion, or twist of the hip capsule, produced by the psoas and iliacus muscles. The tendon of the iliopsoas crosses over the rim of the pelvis to insert into the lesser trochanter of the femur. Reduction of the sacroiliac and lumbar lesions, which are simply effects, seldom secures return to normal posture. The patient often hobbles out the way he came in. The twist in the ligamentous capsule of the hip joint persists and continues the traction on the psoas major and iliacus muscles causing rotation of the lumbar vertebrae. To avoid such strains, instruct your patient to avoid bending while turned and turning while bent. They should return to neutral before assuming another posture.

1 Adapted from: Sutherland, "Standing Posture Technique" and "Standing Posture Technique in Relation to the Sacroiliac," *Contributions of Thought*, pp. 88-90 and 92-95.

As the lesion in the hip joint mechanism was sustained during a standing or stooping position, it responds easily to a technique applied in the same posture. I arrange a chairback or some other piece of furniture so that the patient may rest his arm on it while standing. The operator sits on a chair or stool by the side of the hip in lesion.

The operator fixates the trochanter with one hand, and the fingers of the other hand grasp the tendon of the iliopsoas near its insertion. The patient is then instructed to turn forward and backward. This utilizes the principle of turning a nut on a bolt — that is, turning the acetabulum on the head of the femur. Then the patient furnishes the maximum effort and the physician the minimum in fixating the bone and tendon while the physician is guiding with trained tactile skill.

The secondary sacroiliac lesion is treated in the standing posture with the operator seated by fixating the innominate (pelvic bone) and holding as the patient turns or side-bends while bending the knee on the opposite side and then straightening. [The innominate can be fixated with one hand on the iliac crest and one hand on the ischial tuberosity –Ed.] The iliosacral lesions are treated with the operator still seated. One hand is passed around in front of the pelvis to the crest of the ilium. The patient is then instructed to keep the feet firmly on the floor, supporting his weight with his arms, and to push the pelvis backward and rotate it from side to side while the operator guides the parts into postural alignment.

Mid-back and high-back lesions can be reduced using the standing posture also. This posture provides normal relaxing movement throughout the joints of the vertebral column. The operator fixes his manual contacts on the lesion site with his fingers. The patient is instructed to flex, extend, or side-bend according to the features of the problem.

Postural cooperation between patient and operator can assist in lifting prolapsed viscera during the standing posture. The operator places his hands below the organ and the patient is instructed to stand on tiptoe pushing the pelvis back and forth, finally lowering the heels to the floor.

I have mentioned that there are no muscular agencies to account for the involuntary mobility of the cranial bones at the sutures. I said that the motion at the sacroiliac joints is also involuntary, for there are no muscular agencies between the sacrum and the ilia. The motion between the sacrum and the ilia is accounted for by the action of the intracranial and intraspinal membranes. The other motion occurring at the sacroiliac joints is a postural mobility of the ilia upon the sacrum. Gravity and indirect leverage through the sacroiliac and sacrosciatic ligaments function to produce accommodation to postural demands.

The muscular attachments between the pelvic bones and the femurs have little to do with articular mobility at the sacroiliac joints. H. V. Halladay, D.O., presents a similar thought in his *Applied Anatomy of the Spine*.[2] The sacroiliac ligament and the greater and lesser sacrosciatic ligaments, in their arrangement, act as check ligaments in accommodation to postural demands.

Many sacroiliac lesions occur during the standing posture or when stooped and turned. It often happens that the legs are abducted when the strain pattern occurs. For instance, people usually spread their legs wide apart when pushing a stalled automobile out of a snowbank. While pushing, a person is inclined to inhale and hold the breath. In consequence there is extreme tension placed upon the intraspinal membrane as well as upon the pelvic bones and ligaments, which are moved beyond their normal range of mobility. The same forces may operate when

2 Virgil Halladay, *The Applied Anatomy of the Spine*, Kirksville, MO: Journal Printing Company, 1920), p. 138.

one is in a stooping position, or even when in a sitting position. For instance, a farmer sits on a milking stool with his femurs in abduction. I know of one farmer who sat on the ground around a hill of corn with his femurs in abduction for weeding. He had to call for help to get up onto his feet and later came to my office on crutches.

While experimenting with Dr. Halladay's prepared model in Chicago in 1919, I discovered that abduction of the femurs causes the ilia to rotate so that the sacrum drops forward, thus narrowing the pelvis. Adduction of the femurs rotates the ilia to widen the lateral diameter of the pelvis. This experimentation changed my earlier ideas about diagnosis and correction at the sacroiliac joints.

Diagnosis is best made with the patient in the standing position while testing for motion at the articulation. The patient is provided with a support for his arms at the proper height. The physician sits comfortably immediately in back of the patient. The test is first made with the patient's legs close together. He is instructed to push his hips backward and forward as well as laterally while the physician studies the tension and mobility of the joints. Then the patient abducts both legs for further diagnostic study. These are tests for postural mobility of the ilia upon the sacrum.

The patient is next instructed to inhale deeply while standing in a normal posture. He is asked to think of inhaling in his head more than with his diaphragm. If an ilium or the ilia are immobilized they will move upward along with the sacrum.

The principle used and taught by Dr. Still exercises the natural forces within the patient rather than in the operator. There are no thrusts, no jerks, nor the use of a long lever from a distant part of the body, as a principle. Dr. Still taught the principle of exaggeration of the lesion, or strain, to the degree of release and then of allowing the ligaments to draw the bones back into normal relations.

The patient stands as he did for diagnosis, with his arms or hands supporting him. The operator sits at the patient's back. In case of a fixation on the right side with an anterior or forward rotation of the ilium, the patient abducts his legs and the operator places his left hand on the sacrum at its lower area. He places his right hand on the crest of the right ilium. The patient is then instructed to push forward with the right hip and backward with the left. This exaggerates the lesion to the degree of release. At that point the patient is instructed to move in the opposite way, push forward on the left and backward on the right. The operator's hands guide in the direction of the desired movement.

Another method has the patient bend his knees while the femurs are in abduction. In this position the ilia merely hang in suspension upon the sacrum. In this situation it is as easy to turn the bones at the joints as it is on a skeletal specimen. In some cases the patient may drop the pelvis down on the operator's knees. The knee would then function like the Old Doctor's sacroiliac chair. The pubic arches are shifted from side to side or forward and back. It is as easy to accomplish as trotting a baby on one's knee. The technique can be done with the femurs in adduction, if so indicated. The patient may stand with one leg crossed over the other so as to remove weight bearing from the side of operation. (See Appendix and Figure A.15-16.)

When dealing with problems in this area always check to see whether the head of the femur is twisted in the acetabulum. If it is, external rotation or internal rotation of the leg will cause leverage through the acetabulum that will affect the sacroiliac articulation as well as the psoas major and iliacus muscles. The lumbar spine will then be rotated or bent.

Chronic Spinal Lesions

All the tissues of the body are fluid. The very bone itself is fluid. When there is that interchange between all the fluids of the body, I want you to see a "penetrating oil" working through all the bony articulations. You can establish such a state through compression of the fourth ventricle, lateral fluctuation of the cerebrospinal fluid by contacts on the temporal bones, or contacts on the parietal bones, the greater wings of the sphenoid, or through a contact on the sacrum.

That is what I do in trying to correct old chronic spinal lesions, primary spinal lesions. With the management of the fluctuation of the cerebrospinal fluid you may observe many secondary and compensatory spinal lesions resolving out to their normal relations. That leaves the primary lesions on clear display. Then you can treat them with "penetrating oil." I want to impress upon you that bony tissue is fluid.

The late E. Tracy Parker, D. O., was an early student. He experimented with various ways of using the Tide. He wrote me frequently about the response of old chronic spinal lesions to his endeavors. His patients were as happy as he was with their improvements. He also noted a beneficial effect upon the entire circulatory system with the reduction of congestion, edema, and ischemia.

Anterior Approach to the Sacrum

There are several ways of resolving problems in the postural relation between the ilia and the sacrum. An important problem here is an anterior or ventral sag (bilateral anterior displacement) of the sacrum between the ilia. Remember that any cranial strain will affect a sacral strain, and any sacral strain will affect a cranial strain. Therefore, when there is a sacral strain you should think of the effect on the cranium. It isn't always a cranial lesion that causes your patient to be upset, or disoriented, or distraught.

I had an experience in the days when I drove out into the country with a little team of horses and a buggy. Automobiles could not travel on those roads in mud season because the blue clay would roll up onto the wheels. The horses and the buggy were more reliable. One day, however, the axle on the buggy broke when I was on the way to a house call. It was only twenty-five miles, but it took me quite a while to get there, riding one horse and leading the other.

Along the way I found my patient coming to meet me. I found her in a mentally-strained, distraught state following the birth of her child. After helping her onto the horse I was leading, we finally reached her house. By the time we did arrive, her disturbed state had disappeared, and she was her usual calm self.

After examining her and thinking about her history, I concluded that her sacrum had sagged following delivery and thus created a membranous articular strain in the cranium that especially locked the cerebellum down upon the brain stem, the fourth ventricle, and the cisterna magna in the posterior cranial fossa. But what accounted for the change after riding horseback?

It seemed that the sides of the horse held the femurs laterally so as to provide a traction on the pelvic ligamentous articular mechanism. Then, with the movement of the walking horse, the sacroiliac ligaments could allow the sacrum to become reseated and functional, thus fluctuating the cerebrospinal fluid in the primary respiratory mechanism and relieving the reciprocal tension membrane so that the fulcrum could shift.

Analysis of this experience led me to suggest that "sacral sag" could be corrected from the front. Therefore, the anterior approach to the alae of the sacrum, in an operation that would hold the ilia or turn them laterally while the operator pushed, was devised. It is another example of postural cooperation from the patient combined with a specific and precise procedure from the osteopath.

The framework of the technique is established by having the patient seated on the table. The operator is seated on a stool in front of the patient. The operator places his thumbs on the inside of the crests of the ilia. The fascia provides a place right along there, medial to the crest, where the thumbs can advance toward the alae of the sacrum. The patient places his arms across your shoulders and leans forward as you also lean forward, while advancing your thumbs. When the tension has built up and balanced and the patient's respiratory cooperation is working, the direction of your thumbs tends to move the sacral base up and back. The patient is then asked to sit up and rock the pelvis back in the process. While the patient does this the operator draws the patient's knees medially with his knees so as to keep the ilia from being drawn together in back of the sacral base. The operator does not change the tension in his approach; he maintains it as the patient sits up, for this is the effective point in this operation. It sounds difficult, doesn't it? But it is easy when you know how to have the patient put "the glove on the finger," or thumb, in this instance, rather than advance with force.

When you have advanced your thumb in the direction of the sacral alae a ways, what do you meet? The iliacus muscle and the psoas muscle merge to form a tendon that inserts into the lesser trochanter of the femur. When you have your patient tip forward and put those tissues on your thumbs gradually, where are you? Down near the alae of the sacrum. When your patient rises up, what happens? Can you visualize the action? The operator must keep his contact intact at this step.

Editor's Note: Allowing the patient to put the "glove on the finger" demonstrates a general principle that Dr. Sutherland applied consistently in all of his techniques. That principle was to have the greatest respect for the tissues. Whenever possible in a technique, he would position his finger(s) and then ask the patient to settle the tissue to be treated down onto the finger.

This type of approach to the sacrum is quite different from the old strap technique: strapping the sacrum down and then getting way up at the shoulders to twist the whole trunk around.

I fail to see any intelligence of the mechanism in that. That technique would put you in the sod if you kept it up very long. Some big strong men can handle a long leverage that is aimed to correct, from the top of the trun
bottom, at the lumbosacral junction. It can be corrected just as simply by the patient doing the work. Consider the art of *knowing* and *thinking* versus tinkering.

THE THORAX AND ABDOMEN: FASCIA AND VISCERA

Remember that ribs rotate externally when the thorax inhales and internally when it exhales. This is the general pattern of the action in the involuntary mechanics of the skeletal system. That is, when the midline structures flex, the paired lateral structures move into their external rotation positions, and when the midline structures extend, they move into their positions of internal rotation. Remember also that the diaphragm moves downward with inhalation and upward with exhalation. Thus, the shapes of the internal spaces in the thorax change alternately and rhythmically with the respiratory excursions of motion. This is the fundamental living process of breathing.

Considering the picture of the trunk as a whole region, see the resemblance of the movement of the diaphragm to the movement of a piston in the cylinder of an internal combustion engine. The diaphragm is a transverse fascial septum with muscles in it. It is served by the phrenic nerves and some intercostal nerves. It responds regularly to the involuntary control from the respiratory center in the floor of the fourth ventricle, and it may also be controlled voluntarily. The connections to the diaphragm are not limited to the attachment of the crura to the anterior longitudinal spinal ligament. There are attachments from below, as with the suspension of the liver, and attachments from above where the central tendon of the diaphragm blends into the mediastinal fascia of the thorax, which continues into the anterior cervical fascia to fasten to the undersurface of the head. The diaphragm is not only the roof of the abdomen, but is also the floor of the thorax.

Editor's Note: The viscera of the cervical region are enveloped in a fascial unit composed of the pretracheal fascia anteriorly and the buccopharyngeal fascia posteriorly. The pretracheal fascia is suspended from the hyoid bone, while the buccopharyngeal fascia is suspended from the cranial base. This fascial unit extends into the thorax and blends into the pericardial fascia, which, in turn, merges into the diaphragm. Embryologically, this occurs because the cardiac bud develops at the cephalad end of the embryo and subsequently migrates caudally to its thoracic position. Traveling along with the cardiac bud is the mesenchyme of the oropharyngeal plate and the septum transversum. The mesenchyme develops into the liver and pancreas, which retain attachment to the septum transversum. The septum transversum receives muscular elements from the somites of T6 through L2-3, and together they form the diaphragm.

When picturing the changes in the shapes of the internal spaces of the thorax, note the location of the lateral chain ganglia of the sympathetic nervous system just in front of the heads of the ribs. (See Figure 15.) Also visualize the arterial stream and the venous drainage of the spinal cord in this region. Then locate the lymph stream, the thoracic duct leading from the receptaculum chyli up beside the vertebral column to empty into the left subclavian vein. Consider the significance of the location of the receptaculum chyli upon the aorta and the crura of the diaphragm just over them. (See Figure 18.) What occurs with the alternating changes of the internal spaces within the thorax to influence all of these structures and functions? See the mechanism from the viewpoint of the science of osteopathy.

The Liver Turn

Dr. Still frequently called attention to the fascia, especially the prevertebral fascia. He was a mechanic of the fascia as well as of the skeletal articulations. There was one thing I liked about Dr. Still — he made you think. One topic that required some thinking is the matter of "turning the liver over." He did not tell you how to do it; therefore, you had to think about the liver and what he meant.

Now, how in the name of common sense do you turn the liver over? (See Appendix and Figure A.43.) There is one ideal spot for a careful contact. It is right out at the end of the costal arch on the right, where the lowest rib cartilage attaches to the ribs. Place your finger tips under the edge where the lower ribs join the cartilaginous arch. The anterior border of the liver is just under your fingernails. You are not under the liver; you are above its edge and your fingernails are on the outside of that edge. You can reinforce your hand with the other hand for stability and control. Gently push diagonally toward the midline and hold. Now, let the patient cooperate with controlled respiration. Where does the diaphragm go with inhalation? Down. So you have the patient inhale and hold his breath as long as he can. Then, with the involuntary exhalation, where does the diaphragm go? Up. That is the action that turns the liver over the fulcrum of your fingers. Following the release, the liver can swing freely in its elastic capsule under the diaphragm.

This technique is helpful whenever you find a static drag that prevents the normal mechanical physiology. One clinical condition that usually responds well to this operation is associated with hyperemesis gravidarum. There may be circumstances in which it is practical to do it the other way — that is, ask the patient to exhale and hold the breath out until involuntary inhalation occurs, and note the liver turn when the diaphragm comes down on the fulcrum of your fingers.

The Diaphragm

Let us study the area of the posterior abdominal wall where the crura of the diaphragm are located. Take particular note of the prevertebral fascia, especially that part that is attached to the anterior longitudinal spinal ligament at the level of the second thoracic vertebra. See that it goes up to the undersurface of the basilar process of the occiput, just in front of the cervical spine. Consider drags on the fascia and limitations in the excursion of the diaphragm, not only the crura clamping down onto the receptaculum chyli and the aorta, but also affecting the aperture for the esophagus and the one for the inferior vena cava where the venous return from below passes on its way to the right side of the heart. Can you undo the effects resulting from these drags and limitations? You can.

You can lift the fascias, with the art of postural and respiratory cooperation, from your patient. The pelvic lift is a fundamental place to begin. (The pelvic lift is described on p. 212.) Then follow with lifting the diaphragm and the anterior cervical fascia. (See Appendix and Figures A.39-41.) The pelvic lift utilizes the power of the diaphragm to do the lifting. To get the diaphragm into a lift in the middle of the trunk, have the patient fix his fingers underneath the costal arch on each side. Then place your hands over his. The point is to find the most comfortable controllable grasp on the bottom of the rib cage. Gently lift straight up, cephalad, as the patient breathes in and the sides of the lower rib cage move laterally. Hold the position while the patient exhales. As the diaphragm moves upward in exhalation, you and the patient shift the anterior ribs upward with it and hold. This operation can be repeated several times, slowly and gently for the lifting action upon all the viscera that are dependent on the diaphragm from below.

The Kidney

Did you realize that the kidney floats physiologically on the fascia of the psoas muscle? It can be held down instead of floating, and consequently these conditions may lead to kinks in the ureter. Sometimes there are stones or gravel that form in the pelvis of the kidney that become arrested in the ureter on the way to the urinary bladder. It is always painful when a concretion tries to pass through a hollow organ or potential space and does not succeed. The smooth muscles in the walls are apt

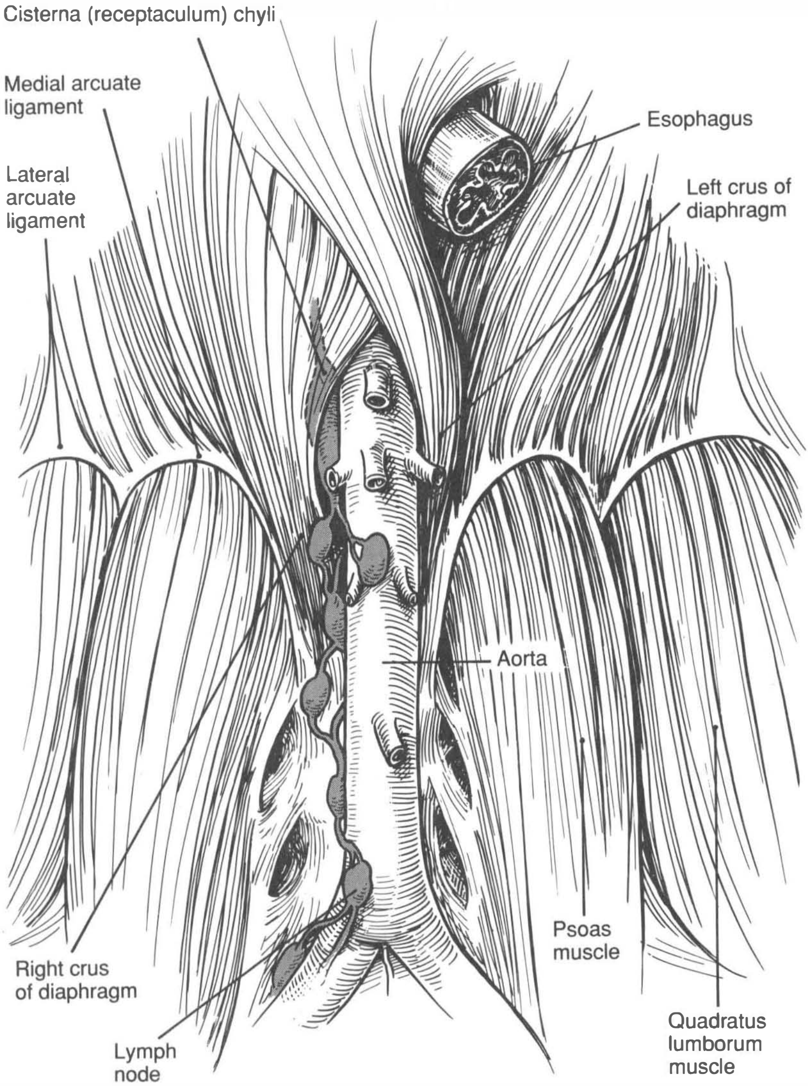

Figure 18. The diaphragm and related structures, particularly showing the relationship of the cisterna (receptaculum) chyli to the crura.

to be powerfully contracted around the predicament. There are ways, including surgery, for searching for the diagnosis and the correct location of the problem. Sometimes the problem is a kink rather than a concretion. In such a case there is nothing to remove, only the spasm to release. If the liver is held down or the kidney is not floating, all you have to do is to lift and see the kidney return to its normal physiologic function. Investigate and consider these mechanical possibilities and their relief by use of the pelvic lift, the lift of the thoracic diaphragm, the anterior cervical fascial lift, and the reciprocal tension membrane of the cranium.

When you want to observe the abdominal viscera that may be in ptosis, with the patient supine gently place one hand over or just below the area of interest. This hand is passive; it does nothing. Then place your other hand over it. You use the upper hand for gentle lifts and observation. That gentle application will tell you a great deal about where you are so that you can feel what the tissues can reveal. The lower hand can be permitted to sink into the tissues below, but the upper hand does the lifting in cooperation with the exhalation excursion of the diaphragm.

The Pelvic Lift

The pelvic lift is a technique for lifting viscera off the pelvic diaphragm. (See Appendix and Figure A.45.) When the pelvis is crowded due to ptosis the levator ani muscle becomes taut, and discomfort, if not dysfunction, follows. As I have said, you use the power of the diaphragm to do the lifting once the operator's contact in the ischiorectal fossa is located so as to hold the lift that goes with exhalation against the fall that accompanies inhalation.

The operator arranges himself and the patient as circumstances permit so that he can insert two fingers into the ischiorectal fossa and advance them with exhalation of the thorax. When the patient lies on his left side the work is done through the right ischiorectal fossa. When the patient lies on his right side the work is done through the left ischiorectal fossa. As the operator leans forward his weight stabilizes the procedure of holding his advance in the fossa when the patient inhales. The lift occurs as the operator advances his contact as the patient exhales and the diaphragm ascends into the thorax. Once this action becomes effective the abdominal viscera are lifted out of the pelvis by the thoracic diaphragm. At that time the patient is asked to hold his breath out, which is then followed by a deep involuntary inhalation. Then the maximum lift has occurred. The benefits of this technique are many. They include relief of discomfort in cases of hiatal hernia, spastic sphincters, unrelieved vomiting, coughing, and some diarrhea that persists beyond usefulness.

The Acute Abdomen

You can use the same intelligent, seeing, feeling, thinking, knowing fingers in diagnosing the acute abdomen, even to the point of clearing up a suspicion of acute appendicitis. You do not go digging in there. I have seen some surgeons do that when they want to find out whether there is a surgical problem. Let your fingers light gently as they do on the skull, like the bird lighting gently on a little limb on a tree. Alight gently over the area and avoid making careless, pointless motions. While your fingers are there they will tell you more in one minute than you can learn by digging in. Why? You have been trained in this gentle way of palpating and perceiving the fine distinctions that are there to be felt.

Then go around the back to the thoracic spine and note whether there is a viscerosomatic reflex in the splanchnic area. Interpretation of such findings tell you so much immediately that you do not have to wait for a blood count to evaluate the problem. You are there, Johnny-on-the-spot.

All of this is an example of the training we were given in the early days of osteopathic education. Thinking, not tinkering. That is why I am trying to bring out the kind of application that is necessary for osteopathic diagnosis and treatment. It is essential to work this way in the cranial field. Certain of the thrust methods often applied to the cervical spine may create cranial lesions. Did you know that sometimes a corrective reduction of a problem in the cervical spine may correct a cranial lesion? Believe it.

Parable of the Goat and the Boulder

In our consideration of the thorax and abdomen, I would relate to you Dr. Still's parable of the goat and the boulder:

> Coming down a familiar mountain path a little goat found a boulder in the way. In goat fashion he gave it a little bump; the boulder did not move and his tail flopped up. He was an energetic little goat so he backed up the mountain and came down the path a little harder, with more energy. Still the boulder remained in the path. Not only his tail but also his hind heels flopped up. He got mad and went way up to the top of the mountain and came down "hell-bent" along the path and hit the boulder. The boulder did not move but the "whole damn works" flopped up.

Then he left you with that story to figure out. The goat represents the valves of the heart. The mountain path is that big arterial stream known as the aorta. The boulder in the path is nothing more than the crura of the diaphragm. When there has been a drag on the fascia, a visceroptosis of the liver, or, perhaps, an impacted colon hanging way down in the pelvis, there has been a problem accumulating that is analogous to the boulder in the path.

A drag on the entire area by way of the crura of the diaphragm puts a drag on the central tendon of the diaphragm and the fascia that surrounds the muscles of the neck. The drag goes all the way up, ventral to the vertebral column. In the story the area of the boulder is the crura of the diaphragm, which are the attachment of the diaphragm to the anterior longitudinal spinal ligament at the level of the upper lumbar vertebrae.

Let us study further this area of the posterior abdominal wall. (See Figure 18.) The crura of the diaphragm cross over the midline. On either side there are two fascial structures called the lumbocostal arches or the arcuate ligaments. The medial lumbocostal arches pass over the psoas major muscles from the transverse processes of the twelfth thoracic vertebra to blend into the crura of the diaphragm. The lateral lumbocostal arches pass over the quadratus lumborum muscles from the tips of the twelfth ribs to the transverse processes of the vertebra. Practically speaking, these structures are interlaced and stabilize the whole back wall of the abdomen at this level. There are two directions in the action here: the crura are lifting up, and the psoas muscles, which go from the lowest vertebrae of the thoracic spine to the lesser trochanters of the femurs, are working down. When there is a strained situation here, as with a twist in the capsule of the hip joint, it is difficult to release a lock at the thoracolumbar junction. When you try to correct a strained position of the mid-lumbar spine, you find it difficult. There is much to be gained from Dr. Still's study of the fascia.

One way to release the "boulder" in the posterior abdominal wall is to use the twelfth ribs as contacts, or handles, for the lateral lumbocostal arches. With the patient supine it is easy to use his weight as a counterforce to your grasp, your plastic contact on the outside of the twelfth rib. Then, all you have to do is lean backward for a controlled lateral traction on the rib and therefore on the lateral lumbocostal arch. This traction gradually extends to the medial lumbocostal arch, and when the strain releases, the diaphragm is released and rises into the rib cage, and the lumbar spine springs free. The "boulder" has disappeared. Then you can use balanced ligamentous tension for the correction of the other strains that you find.

When you carry the floating ribs, the eleventh and the twelfth, laterally you may succeed in relaxing spasm in the pyloric sphincter and the sphincter of Oddi so that the digestive tract in this area will function better. Hiccoughs may fade out with work on strains in the splanchnic area of the thoracic spine as well as on strains in the cervical spine.

Treatment of the ribs can be approached with the patient lying on the side. You can make a sort of hammock of your clasped hands below the rib cage. Standing straight above your hands, you can supply a gentle lift of those ribs. This action moves the heads of the ribs in relation to the vertebrae as the breathing goes on and would be expected to smooth out disturbed function in the splanchnic area. It may be useful in some instances to use fascial lifts of the abdominal viscera in this combination of contacts and respiratory cooperation instead of the pelvic lifts.

SIXTEEN

Problems of Infancy and Childhood

WHEN YOU SEE A child with a misshapen skull, you wonder what happened. Sometimes you can recognize a flexion base with an extension vault, or the opposite, a flexion vault with an extension base. I want to tell you some of the things to think about.

As you observe the outer landmarks and the evidence they provide, consider the inside of the skull and the effect of the warped spaces upon the brain and spinal cord. What has happened to the reciprocal tension membrane and the fluctuation of the cerebrospinal fluid? Do you see that there may be crowding of the cerebral hemisphere on one side and an expanded area on the other? What might happen to the pyramidal tracts with growth, or to the cerebellum? Again, visualize the inside from the analysis of the outside. It is comparatively easy to see the landmarks on a child, even if you can't clarify the evidence with palpation. Remember that the pattern you see may not yet have produced functional problems. There is more room in the heads of infants and children for variations, but as the child grows the lack of symmetry may begin to manifest stresses and strains. It would be a matter of the particular facts and their history to draw a connection with a current problem. This is the "bent twig" phenomenon that is to be thought about. (See Chapter 8.)

Recall that the bones in the cranial base form in a cartilaginous matrix and are in parts at birth. The four parts of the occiput surround the foramen magnum. The sphenoid is in three parts at birth, and the temporal bones are in three parts. (See Figure 12-13.) Consider the possibility of disarrangement among the parts as well as between the bones themselves under the various mechanical events of birth. Then visualize the growth of the cranial base during infancy. Do you see that the slow motion of growth may be a factor that is active in the problems resulting from the early patterns that persist?

A good example of the value of an osteopathic structural examination, including the head, soon after birth has been demonstrated for us by Anna L. Slocum, D.O.[1] In her demonstration, after making the diagnosis of the baby, she treated her. The malformation had occurred during a normal delivery. The bones had failed to realign themselves as usually happens; therefore, the treatment was timely. It is one of the great thrills of your professional life to see the expression of joy and gratitude come over the faces of the parents when they see the change in their child.

Even now we have the possibility of offering encouragement to parents who have been told that their unfortunate child should be placed in an institution. Sometimes we are able to offer more than encouragement. Dr. Slocum is accustomed to providing an osteopathic structural examination to newborn infants in the hospital in Des Moines, Iowa, where every baby born gets that service. The hospital in Kirksville, Missouri, is served by an obstetrician who orders James Keller, D.O.,[2] to examine every newborn infant. As more cranial technicians become experienced in practice, I hope that more can be done to diagnose these problems of malposition and resolve them before they become complicated and arrest the child's growth and development.

1 (1903-1988) Des Moines Still College of Osteopathy, 1939.
2 Dr. Keller was a professor at the Kirksville College of Osteopathy.

Editor's Note: Following this introduction by Dr. Sutherland, Rebecca Lippincott, D.O.,[3] gave a lecture telling how she deals with problems of infants and children as she had experienced them in her practice. The remainder of this chapter are her words.

When you accept an infant or child as a patient, take the time to explain your diagnosis and plan for treatment to the parents. It will help them understand their situation as you see it and learn what you mean when you give them progress reports later. It will also help them explain their understanding to their family and friends.

Children are wonderful patients, generally speaking. They respond to osteopathic care promptly. It will, however, take a few visits for your study of some problems, particularly those involving the cranium. Wait until your study has yielded a clear diagnostic picture before you say more than simply getting acquainted involves. It may take a few months for your evaluation of the patient's response to treatment to provide a basis for prognosis. I take care to promise nothing, for I cannot make a prognosis until I have a progress record for my own understanding.

In my plan for treatment I usually begin at the sacrum. The sacrum is small in infants, but it can be contacted with a couple of fingers without complaint from the patient. If it is crowded by the ilia, just take an innominate (pelvic) bone in each hand and carefully carry each laterally at the same time. Hope that the baby will cry and in crying lift the sacrum out of the crowded condition. Infants and small children seem to be inclined to do just the action that you want when you have the stage set for a technique. Vigorous crying uses the diaphragm and fluctuates the cerebrospinal fluid. You can teach the mother to contact the sacrum and hold it gently whenever the child is restless, upset, or sick. Many times the child will kick as well as cry. I use this as true patient cooperation in making the treatment more successful. The distinction between this cooperation and other types of signaling should be explained to the parents.

3 (1894-1986) Philadelphia College of Osteopathy, 1923.

When examining a sacrum, ask yourself whether it is free to move, whether it is in a position of exaggerated flexion or extension, whether it is twisted between the ilia, and whether it is registering the fluctuation of the cerebrospinal fluid Tide. Babies and children often drop off to sleep when a release of tension has occurred and the mechanism is moving freely. Then you proceed quietly with your examination and treatment without the active help.

It is advisable to have the parents close to the table when examining an infant or young child. They can guard against unexpected movements and thus reassure you and their child by their nearby presence. You may ask them to help in specific ways after everyone has become familiar with the treatment program. You can also instruct the parents in ways to teach their child how to use the benefits of the responses.

The management of the cranial base by using contacts on the vault is the easiest and most comprehensive approach in my experience with examining and treating the cranium in children. It seems that there is much less objection to this contact of the operator's hands. It is also a contact with which you can do many things without having to change. However, I follow the individual's willingness to accept my hands if they clearly indicate a preference. Patients must permit you to examine and treat them, for any patient can completely defeat your efforts if they wish.

The first step with the vault contact is the study of the vault itself. The landmarks on the vault to examine are first the fontanelles and the sutures. The significance of these is self-evident. The characteristics of the frontal eminences, the parietal eminences, and the posterior occipital protuberance are directly related to the situation in the sutures and fontanelles.

The comprehensive diagnostic study of the cranial base through the vault contacts is easily made with your gentle placement of the palmar surface of your fingers on the parietals in back of the parietal eminences. It is easy to visualize the cranium as a "soft-shelled egg" in infants and children. When William Rankin, Sr., D.O., first used that descriptive term, it seemed more significant than thinking of a "modified sphere." The point to consider with either term is the whole head, especially as it is shaped in relation to the pattern at the sphenobasilar junction.

There are particular shapes to think about due to the fact that the bones are in parts at birth and do not form articular gears until growth has required them. Take the four parts of the occiput, for instance, that surround the foramen magnum together with the parts of the atlas. (See Figure 12.) A problem here at the craniovertebral junction is reflected in the contours of the vault, especially the shape of the occipital squama, and sometimes in the infant face, depending upon the effect on the sphenoid. The notes of your careful examination at the first visit will be an invaluable foundation for your progress record.

It is enlightening to watch Dr. Sutherland treat a baby. No matter which contact he uses, he maintains it and goes along with the patient's movements. He may or may not ask the mother to hold the sacrum. He just seems to flow along with the membranes and brings about a state of balanced membranous tension. At that time the baby tends to relax and perhaps go to sleep.

I thought that I could not work with a child crying and squirming when I first started to treat the heads of infants and small children. I learned, however, to keep my attention on what my hands were telling me and what I was doing with my hands. In due time I was able to relax and perceive more even while the child was cooperating vigorously. There is an interesting experiment that you can try with the help of a colleague. One of you takes the part of the infant patient, the other the part of an operator with a hand on the sacrum. The "patient" then behaves like a baby. It isn't quite the same as with a very small patient, but it is interesting to observe how the sacrum feels when the patient is squirming, kicking, and crying. It is good background information for your instructions to parents or others who help when you are working on the head. Or when you are teaching them how to hold the baby's sacrum as a home treatment.

The craniovertebral junction includes the occiput, the atlas, the axis, and all the ligaments that bind this region into a functional part of the whole. This part is a ligamentous articular mechanism, and the joints are synovial joints. The occiput nods in flexion and extension in the facets on the atlas. In other motions the occiput and atlas move together. The movement of the atlas on the axis is a wide range of rotation. Dr. Sutherland has pointed out many times how we should be constantly aware of the mechanical significance of the anterior convergence and posterior divergence of the facets of the atlas and the condyles of the occiput. The facets of the atlas also converge inferiorly and diverge superiorly, and the occipital condyles fit neatly into them. Whenever the condyles have been compressed into these convergences, the direction of release from compression is obviously toward the divergences. (For descriptions of how to release the compression, see pp. 112 and 179.)

Because this region involves these three bones and their ligaments, you can see that the functional junction between the neck and the head is actually at the articulation between the axis and the third cervical vertebra. It is often difficult to make a specific contact with your fingers at this junction in a baby's neck. It is necessary to explore the area, however, because of the possibility of strains connected with delivery that have not yet resolved into the normal action. A wry neck, or torticollis, is not uncommon in very young infants and in itself puts further strain on the neck. Although you must examine the whole neck and the upper chest and shoulder girdle, you will probably find the source of the torticollis to be entrapment neuropathy of the eleventh cranial nerve at the jugular foramen.

You may be busy observing the shape and size of the fontanelles, the vault bones, and the junctions between them while you are allowing your vault contact to become familiar to the patient. Then you can make a gentle contact on the mastoid portions of the temporal bones for an indication of the position of the petrous portions in relation to the basilar process of the occiput. You want to know whether they have glided medially or laterally as well as whether they are rotated internally or externally. You can reason from these observations about the position of the basilar process of the occiput and the body of the sphenoid.

When you are ready to study and diagnose the cranial base, you will want to know all that you can learn about the pattern at the sphenobasilar junction. The systematic process of tests for motion is challenging because of the delicate response in your small patient. The usual routine is the same as in larger patients — that is, flexion, extension, side-bending/rotation, torsion, vertical strain, and lateral strain. In addition to compression, either of the whole base or of some particular area, you recognize the complex combinations of the parts as they may have occurred at this age.

It takes time for all of these observations to be made and noted in an unhurried manner on the first visit. You are establishing the general experience for your professional service, for the patient, for the parents, and as a foundation for future visits. Note your findings and impressions at the first visit precisely as well as any operations that you may have performed together with the response. You may not be satisfied with any accomplishment at this time, but the manner in which you work has significance for the patient and the parents. There is no substitute for getting all the facts that are obtainable as clearly as possible. At the next visit all concerned are prepared to start out according to the manner established. The sequence of findings in your records provides you with facts that are not otherwise available.

When you have a concept of the patient's cranium as a whole, you will be ready to investigate the intraosseous situation, especially in the occiput. The occipital squama is accessible. It will fit right in the palm of your hand. Note the condylosquamal junction on both sides; note whether it is a smooth contour or angulated. If angulated, note whether the angle is acute or obtuse. Also note whether the opisthion is centered or positioned to the right or left of center. It is easy to derotate the occipital squama in early life, whether it is rotated clockwise or counterclockwise. As this is done any compression of the condylar parts that may be associated with it is released.

The occipital squama can have bent at the superior nuchal line as well as at the condylosquamal junction. It may have turned on its vertical axis so that one side is more anterior than the other. Sometimes the squama overrides the posterior ends of the condylar parts, or it may be tucked inside them. Any of these possibilities of disarrangement affects the reciprocal tension membrane, because the posterior pole of its attachment is located on the inside of the occipital squama; therefore, you have a contact on that mechanism right in the palm of your hand.

The area at the anterior ends of the condylar parts and the posterior end of the basilar process is not accessible to direct contact. The junction of the anterior end of the basilar process with the posterior of the body of the sphenoid (the sphenobasilar junction), and the articulations of the petrous portions of the temporal bones with the basilar process constitute the rest of the inaccessible area of the cranial base. This area is understood through visualization and reasoning from your accessible contacts on the outside.

The study of the occipitoatlantal joints is led by your reasoning through the understanding of the mechanical significance of the anterior convergence/posterior divergence in the facets of the atlas and the condyles of the occiput. The capsule of these joints includes the basilar process of the occiput with the condyles. This is the place where the shape of the foramen magnum is determined; therefore, this is the place where the four parts of the occiput are relatively free early in life to arrange themselves in their cartilaginous matrix. It is also relatively easy for them to rearrange themselves, especially with osteopathic assistance.

Correction and adjustment of problems between the bones of the cranial base should precede any intraosseous molding. Once the field is prepared you can mold the parts of the temporal bones, the parts of the sphenoid, the occipital squama, the frontal bones, the facial bones, and the parietal bones. Needless to say, molding procedures are carried out gradually in an extended program that allows for the growth that is going on in infancy and early childhood.

Dr. Sutherland likens one of the molding techniques he has taught to pushing the center of a rubber saucer so as to spread the circumference. This is especially applicable to the bones of the vault that have eminences. It is valuable when combined with directing the Tide to free the periphery of a bone. As you direct the Tide, place the palm of a hand over the eminence or ossification center that has become bunched up. This bunching up has been a consequence of resistance at the periphery. Unless that resistance is removed, the molding will not occur. The area of resistance at an edge need not be extensive to result in these "horns."

Editor's Note: This molding technique suggests a vault that is flexible. This is true to some extent even in the adult, where the osseous vault has two tables of bone with diploe between, and both tables are flexible. To emphasize their membranous origin and flexibility, Dr. Sutherland sometimes called the osseous vault "father dura."

I have frequently found a recurrence of a strain pattern to follow an initially excellent response to treatment. This has prompted me to plan for visits at six month intervals so that I can address these developments related to growth. It takes only a couple of timely visits to correct these recurrences. Sometimes they have been related to the inevitable falls that go along with learning to walk, rather than to growth.

Some strain patterns seem to be more productive of clinical problems than others. The lateral strain pattern that results in the so-called parallelogram deformity of the head seems to affect the interior spaces of the cranium with more dysfunctions of the central nervous system than others.

The principles that I use in the osteopathic treatment of problems in infants and children are:

1. balanced membranous tension
2. management of the fluctuation of the cerebrospinal fluid
3. directing the Tide

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SEVENTEEN

A Tour of the Minnow

In this tour of the living human brain we are like a little minnow on a sightseeing tour. We are taking a swim in the cerebrospinal fluid with a little minnow who can crawl into crevices such as the entrances to the fourth ventricle from the subarachnoid space. As we look, we will try to reason out some of the functions in this neural tube. We are taking a flight of the imagination.

In this little swim I hope to gain some understanding of the mechanical features of the motion of the pituitary body in the sella turcica of the sphenoid bone. I am also seeking to understand the motion of the pineal body up at the back of the roof of the third ventricle. Philosophers have historically searched for the seat of the soul in this area.

The little minnow plunges through the door into the fluid within the fourth ventricle. These doors (the foramen of Magendie and the foramina of Luschka) that open between the body of cerebrospinal fluid in the subarachnoid space outside the neural tube and the body of fluid within the ventricles inside the neural tube are the only open doors between the two bodies of fluid. What the minnow finds in the fourth ventricle is a corridor under a roof. The cerebellum lies above the roof. The corridor extends down into the central canal of the spinal cord and upward into the cerebral aqueduct.

He feels aware of the fluid; he feels that it is doing something. Out of the darkness he sees a light. It is like sunlight in a cloud or a reflection in a cloud. There is a lot of light, but it does not touch the cloud. It reflects all through it. It also reflects some Intelligence to the little minnow, coming from something invisible. The "liquid light" seems to lead him on.

So he swims on along with that knowledge, that information from his first dive into the clouds within the fourth ventricle. He dives down to the very bottom and becomes aware of a transmutation from the light to all the physiologic centers within the medulla oblongata. Then he swims around and drifts sideways until he finds a little narrow channel known as the cerebral aqueduct. It is hard to find his way in this narrow channel.

Suddenly, he feels a little push behind him, and it pushes him through as he sees that the undulations of the walls permit it. Right under him is another undulation that must be the sphenobasilar junction arching up and down, an undulation that follows the tide and sets him on course to the top of a big cavern known as the third ventricle. This cavern is full to the top with cerebrospinal fluid.

He turns a bit and sees that this cavern is very narrow and just above there is a little tube (the pineal stalk and recess) that runs to a connection with something called the pineal body. He sticks his nose into that tube and gets stuck. Suddenly, that body, that cone, begins to move up, and then it lets him go as it has now flopped down. He feels the up and down action in that little pineal body. What accounts for this mechanical action, this flipping up and flopping down?

The roots and tracts in this area and in the roof of the midbrain connect up with the roots of the anterior lobe of the cerebellum, the oldest part. This is the part of the neural tube that has neural tissue as its roof. There must be a mechanical principle in the area for the flip-flop of the pineal body to occur during inhalation and exhalation of the primary respiratory mechanism, in a definite rhythm. When the little cone goes down in exhalation, it rests on top of the superior colliculi.

While the minnow is still on the roof of the third ventricle, on the inside, he sees a curtain that separates the chamber from the outside of the brain. He stretches his imagination so as to see the choroid plexus above it, stretched out in inhalation. Then exhalation begins, and the walls come together to make a narrow chasm again. In exhalation that choroid plexus bunches up the way it is found in the cadaver. He feels the difference between inhalation and exhalation while in the third ventricle. It changes its shape from a V-shape that is wider at the top, thus lifting up the bottom, to a narrow chasm that drops it. So he dives down to the bottom and meets the floor of the third ventricle, the hypothalamus. It seems to have a hole in the bottom and he feels the movement, up and down.

This hole leads down and he slips through to find himself in the pituitary body, in the neurohypophysis. Now inside the pituitary body he is also in the sella turcica of the sphenoid bone. He is tired, so he falls asleep when he settles down, and is rocked as in a cradle.

When he awakens he discovers that he cannot get out of there. The pituitary body is strapped down by a diaphragm. He must find that infundibulum in order to slip back up into the hypothalamus — that is, into the third ventricle. This must be a special area with the infundibulum connecting the pituitary body with the hypothalamus. It seems to be a center of some sort with many nuclei in such a small area. There is a lot of action here with all the rocking up and down and the motility. Ah! It is the sphenoid bone turning regularly that does the rocking. The motion must be important to all these working parts.

As the little minnow swims up in the third ventricle he hears a hum and feels that he should be careful as he goes by the thalami and the basal ganglia, because there is such a charge in these walls. He moves along and finds the end wall, the lamina terminalis. There are two open doors in this wall, the interventricular foramina. He pushes into the right one and finds himself in the right lateral ventricle. As he goes forward in this he bumps into the frontal lobe, so he has to turn around. This whole anterior area seems to have become a superior area. It is where the neural tube folded up and back over along the top of the head. The next part of his swim is where the motor cortex of the brain surrounds the ventricle, where the orders go forth to tell something to move. At the back of the cranium he finds that the occipital lobe turns again, downward and forward. The visual cortex is here, the part that does the seeing, close to the falx cerebri and the tentorium cerebelli. The temporal lobes of the brain are tucked forward into the inside of the greater wings of the sphenoid. All of this lies above the "tent" (tentorium cerebelli). What would happen if this angle between the falx and the "tent" became acute and squeezed the visual cortex?

Once more he is in a place where he has to turn around. So he swims back along the right lateral ventricle to enter the third ventricle again. This whole swim has been a spiral path. The left lateral ventricle must have one like it. The cerebral hemispheres folded up and over and back and forward from the front end of the brain stem. So where is the outside found in the middle? It must be the great transverse fissure of the brain. The tentorium cerebelli is between the contents of the posterior cranial fossa and the occipital and temporal lobes. This place in the middle is where the pineal body lies upon the superior colliculi of the midbrain, on the outside of the neural tube.

But our minnow is inside, back in the third ventricle where he has some fluid to swim in. He gets back to the fourth ventricle through the cerebral aqueduct and finds his way out of the door into the subarachnoid space — into the cisterna magna. There is room to swim in this lake, too. He can swim around the medulla oblongata on the outside and see the cerebellum like the bellows that blacksmiths use to blow air on their fire. He can feel the tide coming in.

The little minnow swims next under the brain stem and into the water beds that the brain rests upon: the cisterna basalis. He comes up around the pons to go above the cerebellum into the superior cistern and there he is again right on the outside and in the great transverse fissure. He can see not only the pineal body, that little cone, but also the deep cerebral veins, the choroidal veins, and the cerebellar veins, all converging and entering the great vein of Galen just before it enters the straight sinus.

Then the little minnow wanders around the outside of the hemispheres of the brain in the subarachnoid distribution of the cerebrospinal fluid, beneath the arachnoid membrane and outside the pia mater. He notes how closely the pia mater fits to the surface of the neural tube carrying arterial blood. The arachnoid membrane spans across the tops of the sulci and fissures. This arrangement provides him with the fluid in which to swim.

He thinks, however, that it is not much in some places and wonders what would happen if that arachnoid membrane became locked down upon him while in one of these spaces. The space would get smaller and he might not be able to get into all that fluid around the outside of the brain or into the fluid on the outside of the spinal cord. Could he get around the medulla if it were jammed down into the foramen magnum? What would have to happen to produce that situation?

He can see that if the occiput and the temporal bones were not working right, the tentorium cerebelli could become locked, and the shape of the posterior cranial fossa would be changed. The shape of the jugular fossa would also be changed. Would these changes affect the movement of the venous blood toward and out of the jugular foramina? If the outflow of venous blood from the cranium were restricted, would you feel good? Would you have a headache? What events might happen that would put a strain on the relations between the occiput and the temporal bones?

Suppose a person were hit on the top of the head. Would that blow jam down on the fluid there in front of the pituitary body and around it? It seems that there are many spaces around the outside of the brain where the fluid should not be disturbed. What if the head became warped into a side-bending/rotation shape so that one chamber of fluid became smaller and its like on the other side became larger? Would there be more fluid where there was more room and less fluid where there was less room? Could that situation be straightened out?

This tour is long enough. He has been inside the cranium all the time while touring on the inside and on the outside of the living human brain. The little minnow has seen enough to provide thought for a long time.

APPENDIX

The Osteopathic Technique of Wm. G. Sutherland, D.O.[1]

H. A. Lippincott, D.O.

AT THE TIME THAT Dr. Sutherland received his osteopathic training at Kirksville, Dr. Andrew Taylor Still was carefully supervising all the instruction given at the college. The principles that were taught had to conform exactly to his concept. Dr. Sutherland made good use of every opportunity to learn and understand them and has adhered closely in his thinking and practice to Dr. Still's principles throughout his professional career. In consequence, the technique which he has presented to us is a reflection of the clear vision of our founder. In these days of rapid changes in medicine, older methods are constantly being replaced by new, and there is scoffing at the procedures that were used in the day of our grandfathers. On the other hand, the changes in the human structure, due to environment, are such that it is now even more susceptible to the strains that were considered by Dr. Still to be the most important cause of disease. Physical response to various types of osteopathic treatment is essentially the same now as in the nineteenth century. The technique presented here is of more than historical interest; it is of real practical value in our everyday work.

GENERAL CONSIDERATIONS

Ligamentous Articular Strains

Osteopathic lesions are strains of the tissues of the body. When they involve joints, it is the ligaments that are primarily affected, so

1 This article was originally published in the 1949 *Year Book* of the Academy of Applied Osteopathy.

the term "ligamentous articular strain" is the one preferred by Dr. Sutherland. The ligaments of a joint are normally on a balanced, reciprocal tension, and seldom if ever are they completely relaxed throughout the normal range of movement. When the motion is carried beyond that range, the tension is unbalanced, and the elements of the ligamentous structure which limit motion in that direction are strained and weakened. The lesion is maintained by the overbalance of the reciprocal tension by the elements which have not been strained. This locks the articular mechanism or prevents its free and normal movement. The unbalanced tension causes the bones to assume a position that is nearer that in which the strain was produced than would be the case if the tension were normal, and the weakened part of the ligaments permits motion in the direction of the lesion in excess of normal. The range of movement in the opposite direction is limited by the more firm and unopposed tension of the elements which had not been strained.

Principles of Corrective Technique

Since it is the ligaments that are primarily involved in the maintenance of the lesion, it is they, not muscular leverage, that are used as the main agency for reduction. The articulation is carried in the direction of the lesion, exaggerating the lesion position as far as is necessary to cause the tension of the weakened elements of the ligamentous structure to be equal to, or slightly in excess of, the tension of those that were not strained.

This is the point of balanced tension. Forcing the joint to move beyond that point adds to the strain which is already present. Forcing the articulation back and away from the direction of lesion strains the ligaments that are normal and unopposed, and if it is done with thrusts or jerks there is a definite possibility of separating fibers of the ligaments from their bony attachments. When the tension is properly balanced, the respiratory or muscular cooperation of the patient is employed to overcome the resistance of the defense mechanism of the body to the release of the lesion. If the patient holds the breath in or out as long as possible, there is a period during his involuntary efforts to resume breathing when the release takes place. In appendicular lesions the patient holds the articulation in the position of exaggeration, and the release occurs through the agency of the ligaments when, or just before, the muscles are relaxed.

There are exceptions to the general principle of correction by exaggerating the lesion position. The disengagement method, with the rib technique as an example, uses a fulcrum upon which a leverage tends to separate the bony surfaces and tense the ligamentous connections. This method is combined with exaggeration of the lesion position in treatment of the long bones of the extremities. Under some circumstances it is unwise to add tension to the involved ligaments, as in the case of a severe strain of recent production. In that event the pain will be increased under exaggeration, and the correction is made by holding the more distal bone in the direction of the normal position while the patient participates by gently and slowly moving the proximal bone toward its proper relationship. This is known as the "direct action" technique. It is used in the postural sacroiliac or iliosacral lesion in which the irregularity of the auricular surfaces prevents a wide range of motion, especially on the axis through the second sacral segment.

The participation of the patient in the technique is a matter of importance. If the operator holds the bone which is in lesion and the patient moves the one upon which it is lesioned, there is less likely to be undue strain placed upon the ligaments than if the operator exerts the force necessary to accomplish a reduction. Considering the lesioned bone as the "bolt" and the one proximal to it as the "nut," it is a better mechanical principle for the operator to hold the bolt and allow the patient to turn the nut than for the operator to turn the bolt.

The physical equipment needed for this technique is simple. An osteopathic table, a stool, and a chair are the main items. Mention is made of use of the Ritter stool in some of the procedures. It is a stool that tilts from the base; the seat turns and is adjustable for height. The stool is made with a minimum height of twenty-one inches for use in this work. Of greatest importance, however, is the mental equipment of the operator, his ability to visualize the structures concerned in the lesion, and the keen tactile sense common to osteopathic physicians.

CERVICAL VERTEBRAE

From the axis to the seventh cervical vertebra the articular surfaces lie in a plane that is tipped anteriorly from the coronal, so, in flexion, the articular processes of one vertebra move upward and forward in relation to the one below, and in rotation sidebending, the movement is in that direction on the side that is anterior and convex. In extension the articular processes move relatively downward and posteriorly as does the one on the posterior and concave side in rotation sidebending. The anterior convexity of the cervical curve is reduced or straightened when the neck is bent forward in flexion, increasing the distance from the occiput to the shoulders. That distance is also increased on the anterior side in rotation sidebending and is reduced in extension, as well as on the posterior side in rotation sidebending. The technique for correction of cervical ligamentous articular strains makes use of those principles. The articular processes that are relatively anterior or that move anterosuperiorly more easily, are held anterosuperiorly to balance the tension of the capsular ligaments, and the shoulders of the patient are placed so that the lesion position is exaggerated.

The manner in which the patient holds the neck, especially in acute lesions, and the altered bony relationships and soft tissue pathology noted under palpation give evidence of the location and type of lesion. The determining factor, however, is the freedom or restriction of motion. The articulation moves more freely and usually with less discomfort to the patient in the direction of the lesion than in the opposite direction.

The technique is best applied with the patient supine and relaxed, but when circumstances do not permit this, the physician can use his ingenuity in adapting the technique to the position that can be assumed. It is said that Dr. Still, meeting a patient on the street, would even stand him against a tree to reduce a sacroiliac lesion. There is considerable latitude in applying Dr. Sutherland's technique providing the underlying principles are not violated. The position of the shoulders is taken without appreciable strain or tension of the muscles, the purpose being only to affect the ligamentous tension by altering the relative position of the attachments of the ligaments.

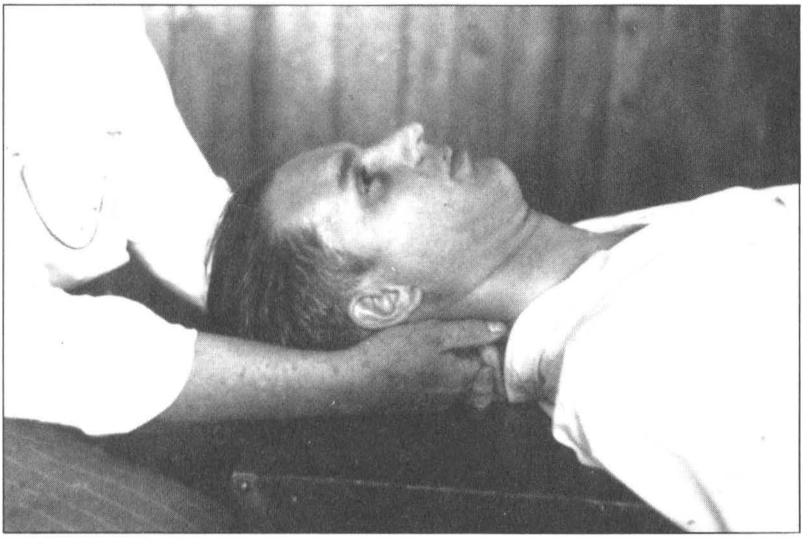

Figure A.1. Cervical Technique: In this case the fingers are crossed to contact the articular processes on the opposite side.

Flexion Lesions

The articular processes of the upper of the two vertebrae involved are held anterosuperiorly by the tips of the operator's fingers, the direction being in the plane of the articular surfaces. The patient lowers both shoulders toward the hips avoiding any abduction of the arms. The point of balanced tension is found by the operator and held during respiratory cooperation in inhalation, which also tends to reduce the anterior convexity of the cervical spine.

Extension Lesions

These are corrected with the processes of the lower of the two vertebrae held anterosuperiorly, the patient's shoulders moved cranialward, and respiration cooperation in exhalation.

Rotation Sidebending Lesions

The articular process of the upper vertebra on the side of convexity is relatively anterosuperior, and it is held in that direction by the operator.

The one on the opposite side of the vertebra below is held anterosuperiorly under the inferior facet of the upper one, which is relatively posterior and downward. The shoulder is lowered on the side of convexity to increase the separation of the facets and the opposite one is elevated to carry the superior process of the lower vertebra anteriorly and upward. The patient holds the breath either in or out, sometimes depending on whether the strain is greater where the articular processes are separated or approximated. Respiratory cooperation follows the general rule that inhalation is associated with flexion and external rotation, exhalation with extension and internal rotation. The point of balanced ligamentous tension may be rather elusive, making it necessary to slightly alter the degree of pressure on the articular processes or the height of the shoulders. The greater strain may be in the ligaments of either one side or the other, so the tension may have to be varied to attain balance.

Condyloatlantal Lesions

The articular pits of the atlas converge anteriorly and inferiorly, and they curve cranialward to a position anterior to the occipital condyles. The motion permitted is a nodding of the head as the condyles rock forward and back in the cup-shaped pits of the atlas.

Correction of the condyloatlantal lesion is made with the patient supine as the position of choice. The operator places the tip of a finger against the posterior tubercle of the atlas and holds that bone anteriorly to prevent it from moving dorsally with the condyles as the patient nods or tips his head forward, avoiding flexion of the cervical spine. This rocks the occiput posteriorly in the pits, releasing the condyles from the atlas, and tenses the ligaments. The right and left articulations will find a point of balance between them, perceptible to the operator as a slight springing or elastic resistance of the ligaments. This position is held while the patient holds the breath in either inhalation or exhalation. Release of the fixation is frequently perceptible to both the patient and the operator, usually during the respiratory efforts just before the patient must resume breathing. This technique

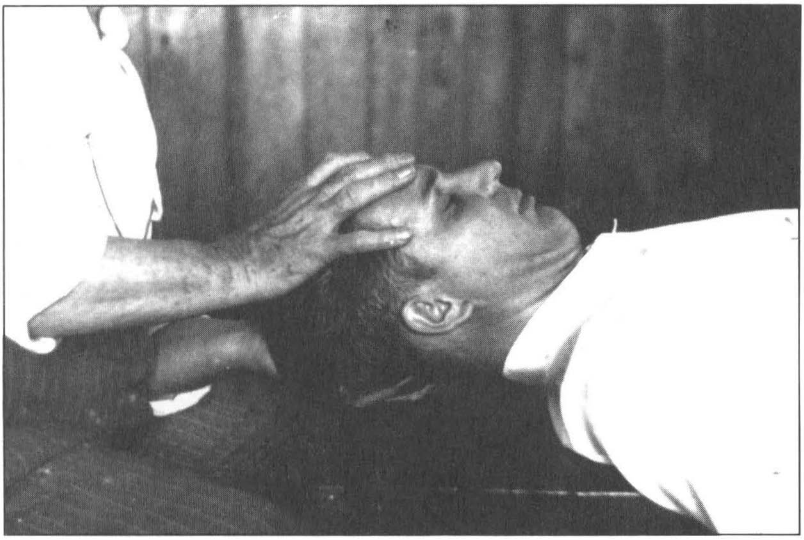

Figure A.2. Condyloatlantal

is effective whether the lesion be unilateral or bilateral, or the condyles be held in the anterior, posterior, or lateral position.

Atlanto-Axial Lesions

Dr. Sutherland finds that ligamentous strains of the atlanto-axial articulation frequently become apparent following the successful reduction of those of the condyloatlantal articulation, indicating that they are of a compensatory nature. It occurs to him that the ligamentous agencies of that region function somewhat in the manner of the hairspring of the balance wheel of a watch, causing motion of the occiput to be reciprocated between the atlas and axis.

Although the articular structure and the motion are quite different from those of the typical cervical vertebrae, the technique is similar. In arriving at a ligamentous balance between the atlas and axis, it is to be remembered that the motion is almost entirely rotation with little sidebending, and that the superior facets of the axis face cranialward and laterally. The shoulder and respiratory cooperation are employed as in the technique for lesions of the typical cervical articulations.

THORACIC VERTEBRAE

The facets of the superior articular processes face dorsally, cranially, and laterally, those of the inferior processes facing ventrally, caudally, and medially. Consequently in flexion the transverse processes of one vertebra move anteriorly and superiorly in relation to those of the one below, and in extension, posteroinferiorly. In sidebending rotation the transverse process on the side of convexity moves cranially, anteriorly, and slightly medially away from the one below, and on the side of concavity the two processes approximate and the upper one moves dorsally. Elevation of the shoulders tends to separate the transverse processes and move the inferior articular facets anterosuperiorly on the superior articular surfaces of the vertebra below, approximately the relationship which exists during flexion. When the shoulders are lowered the articular processes assume the relationship present in extension. Elevating one shoulder separates the transverse processes on that side, and the upper one moves anteriorly, as on the side of convexity in sidebending rotation, while lowering of the shoulder produces the relationship which is present on the side of the concavity. Technique for the correction of thoracic vertebral lesions employs cooperation by the patient based on these principles.

Palpation for Motion

With the patient seated or supine, the operator places a finger on each transverse process of the vertebra in question. The patient elevates the shoulders slowly, then lowers them toward the hips, then raises one and lowers the other alternately while the operator palpates for freedom of motion. The location and direction of the strain having been ascertained, the transverse processes of the involved vertebrae, which (processes) are in the relatively anterior position, are held anteriorly in the plane of the articular facets to exaggerate the lesion position.

Flexion Lesions

The processes of the upper of the two vertebrae are held anterosuperiorly while the patient elevates both shoulders to balance the ligamentous tension as determined by the operator. This position is held while the patient inhales and holds the breath.

Figure A.3. Thoracic Vertebra: The transverse process on only one side may be held anterosuperiorly for exaggeration of the lesion position.

Extension Lesions

Extension lesions are corrected with the transverse processes of the lower of the two vertebrae being held anterosuperiorly, and the patient's shoulders lowered. Respiratory cooperation is in exhalation.

Sidebending Rotation Lesions

On the side of convexity the transverse process of the upper vertebra, and on the concavity that of the lower one, are held anterosuperiorly. The patient elevates the shoulder on the side of convexity, lowers the other one and carries it slightly posteriorly. The point of balanced tension is found, and the respiratory cooperation may be in either inhalation or exhalation — inhalation if the ligamentous imbalance is on the side of convexity, and exhalation if on the concavity.

Patient on Knees of Operator

In another method of correcting thoracic vertebral lesions, the patient is seated on the knees of the operator, or on a Ritter stool, facing the table. The forearm of the operator holds the patient's pelvis

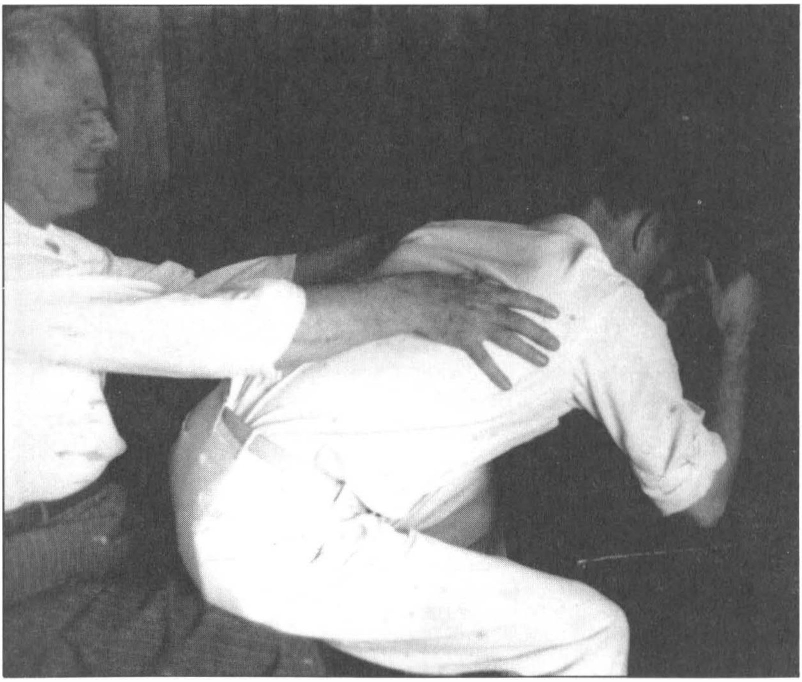

Figure A.4. Thoracic Vertebra: Convexity to the left.

posteriorly. The patient rests his elbows on the table and walks, or inches, forward with them to carry the inferior articular processes craniad in relation to the superior ones of the vertebra below. The operator palpates at the transverse process for limitation of motion and for the point of balanced ligamentous tension.

Flexion

If the lesion is of the flexion type, a finger on each transverse process of the upper of the two vertebrae lightly encourages their anterosuperior movement while palpating for the proper degree of separation from the vertebra below as the patient steps forward with his elbows on the table. When that point is reached the correction is accomplished with the patient holding the breath in inhalation.

Extension

The operator's fingers are placed on the transverse processes of the lower of the two vertebrae involved, the patient steps forward with his elbows until that vertebra is felt to move upward. The transverse processes are then held gently in an anterosuperior direction while the patient steps backward with his elbows for an inch or two. This carries the articular processes of the upper of the two vertebrae back to exaggerate the extension position at the point of lesion. The correction is made during exhalation.

Sidebending Rotation

In correcting these lesions, the forearm of the operator which is on the side of the convexity holds the pelvis posteriorly. A finger of the other hand is placed on the transverse process of the upper of the vertebrae involved, on the side of convexity. That finger gently holds the process in an anterosuperior direction as the patient steps forward on his elbows until tension is palpated with the finger. Then the patient moves forward the elbow on the side of convexity, lowering the shoulder on that side toward the table, as directed by the operator. The respiratory cooperation may be in either inhalation or exhalation.

LUMBAR VERTEBRAE

The two inferior articular processes of each lumbar vertebra are cupped anteriorly and laterally between the superior articular processes of the vertebra below. This pattern is usually present at the dorsolumbar and lumbosacral junctions. It permits one or both facets of one vertebra to glide up and down in the trough made by the facets of the next lower vertebra. The arrangement of the joint surfaces and of the capsular ligaments is kept in mind as the corrective technique is applied.

The patient is seated on the operator's knees or on a Ritter stool facing the table. The operator holds the patient's pelvis with his forearm anterior to the ilia, and the patient moves his elbows alternately forward on the table. This increases the tension on the capsular ligaments and separates the spinous processes. Tilting the patient's pelvis laterally with the knees produces sidebending of the lumbar spine which can be localized by the palpating finger of the operator, placed on the spinous process of the vertebra in lesion.

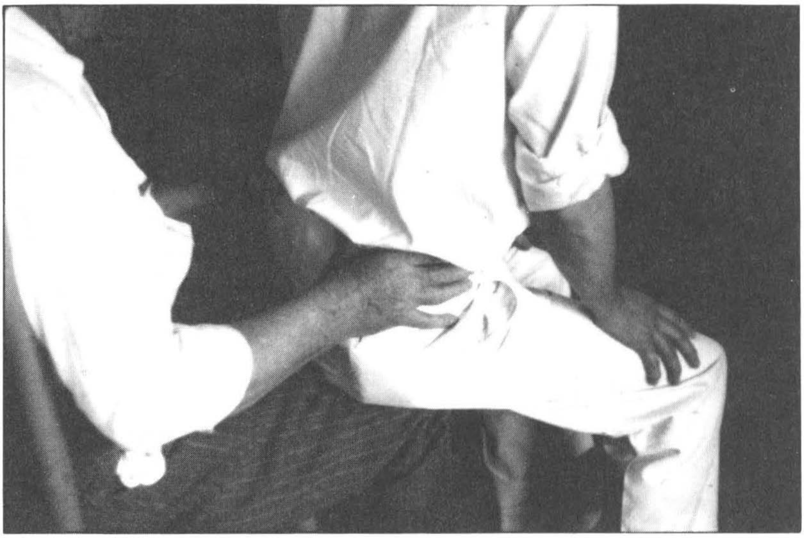

Figure A.5. Lumbar: Palpation of motion as the hips are elevated alternately.

Flexion

The patient moves forward with his elbows until the increase of ligamentous tension is noted by the operator, the spinous process of the upper of the two vertebrae is held in a cranial direction to exaggerate the lesion position, and the patient then holds the breath in inhalation for correction.

Extension

In the extension lesion the pelvis is steadied, the ligaments are tensed as above, the operator holds the spinous process of the lower of the two vertebrae anterosuperiorly, and the patient moves back on his elbows to balance the tension in extension at the point of lesion. Then the respiratory cooperation is in the exhalation phase.

Sidebending

The sidebending lesion position is exaggerated to the proper extent by elevating the pelvis on the side of concavity. The arm of the operator on the side of convexity holds the pelvis posteriorly as the patient

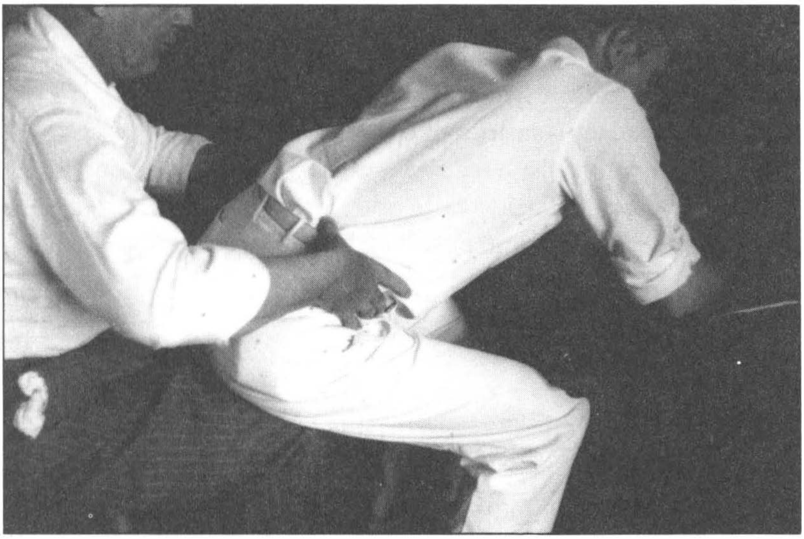

Figure A.6. Lumbar Correction: Convexity to the left. The ilia are held posteriorly by the fingers.

steps forward with his elbows to tense the ligaments. The operator holds the spinous process of the lesioned vertebra toward the convexity and the patient comes back with his elbows until the finger on the spinous process notes a balancing of the ligamentous tension. Then the patient inhales and holds the breath for correction which usually occurs at the beginning of exhalation.

RIBS

The rib lesion is considered as an articular strain of the capsular, radiate, and interarticular ligaments connecting the head of the rib to the bodies of the vertebrae. In the corrective technique the ligaments are tensed by using first degree leverage of the rib to lift its head anterolaterally from the facets on the vertebral bodies. The rib is shaped somewhat like a horseshoe with a long arm from the angle to the anterior end and a short arm from the angle to the head of the rib. The costotransverse articulation acts as the fulcrum as the operator holds the shaft of the rib to prevent it from moving forward when the patient rotates the bodies of the vertebrae away from the head of the rib. The technique is usually applied with the patient seated and the operator on the side of lesion holding the rib. However, it may be done with the patient lying on the back or on the side opposite the lesion. The patient is instructed to keep his head erect and not twist the neck as he turns the body ***slowly***, carrying posteriorly the shoulder on the side opposite the lesion. In other words, the operator holds the "bolt" while the patient turns the "nut" to release the fixation. Sensing the point at which the ligaments are tensed but not unduly stretched, the operator instructs the patient to hold that position while he inhales and holds the breath for correction of the lesion.

Diagnosis is made in the usual manner, considering history of trauma, pain and tenderness, tissue tensity and induration, possible abnormality of position, and restricted motion. If the first and the last two diagnostic points indicate a rotation of the rib in a particular direction, that position may be held in exaggeration for the correction; otherwise simple disengagement of the costocentral articulation alone is used.

Fourth to Tenth

For lesions of the fourth to tenth ribs, inclusive, the middle finger of one hand of the operator is on the angle, and the middle finger of the other hand is on the anterior end of the shaft of the rib, and the thumbs are placed laterally on the shaft. Firm contact is obtained by the patient's leaning toward the operator. The rib is held to prevent it from moving anteriorly, and the patient slowly rotates the upper part of the body, carrying the opposite shoulder posteriorly, to the point of balanced tension of the ligaments. He then inhales and holds the breath.

Second and Third

These ribs are covered posteriorly by the scapula, and the first rib, by heavy muscles, necessitating a different approach in holding those ribs posteriorly. The patient raises the shoulder, and the operator's thumb, of the hand which is toward the front of the patient, follows upward and backward from the axilla, close to the scapula, to contact the rib as near the angle as possible. The thumb maintains that contact while the patient gently lowers the shoulder, like slipping a glove down over the thumb, thereby causing a minimum of discomfort to

Figure A.7. Rib Technique

the patient. A finger of the same hand holds the anterior end of the shaft, and a finger of the other hand holds the posterior part of the rib near the point where it meets the transverse process. The thumb of this hand is placed at the inferior part of the lateral border of the scapula and holds that bone medially, posteriorly, and upward away from the other thumb. The patient's elbow is allowed to drop close to the body. Leaning toward the operator, the direction in which the rib is held, rotation of the trunk and respiratory cooperation are similar to the technique described above.

First Rib

When contact with the first rib cannot be made comfortably by way of the axilla, it may be accomplished with the thumb starting lateral to the trapezius and following the rib medially under the muscle, advancing as the patient inhales, and holding during exhalation to arrive at the posterior surface of the rib. If necessary, the hold may be through the muscle itself, but this is not as specific or effective. The rest of the technique is as above.

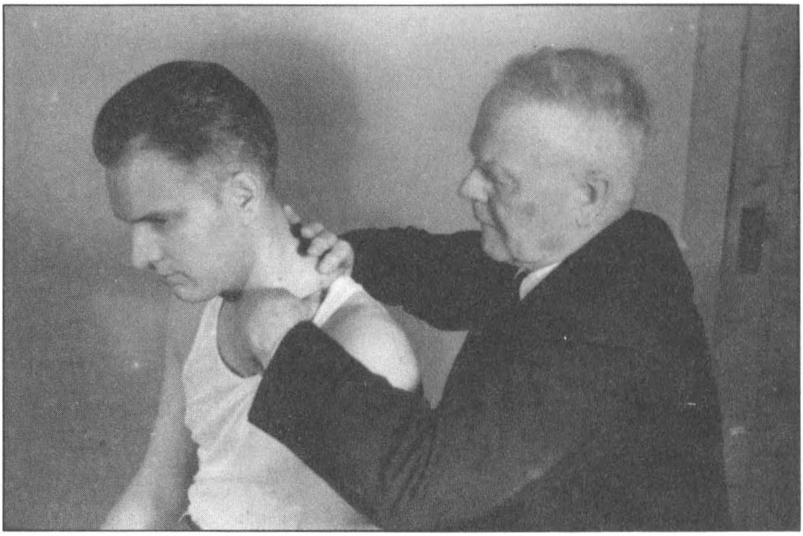

Figure A.8. First Rib: Thumb under the trapezius.

Bedside Technique For Upper Ribs

A simple procedure for the reduction of upper rib lesions that can be used at the bedside is to have the patient seated with his hands or forearms resting on the shoulders of the operator, who is seated facing him. The operator holds the sternal end of the rib posteriorly with the fingers while the patient rotates the body, carrying posteriorly the shoulder opposite the lesion. This disengages the head of the rib for correction with respiratory cooperation.

Floating Ribs

There is no costotransverse articulation to serve as a fulcrum for the eleventh and twelfth ribs. Consequently in correcting lesions of the eleventh and twelfth, the rib is held as are the other middle or lower ribs, but the finger which is placed posteriorly is held firmly forward against the rib near the vertebra to act as a fulcrum. The shaft is held posterolaterally while the patient rotates the trunk and holds the breath.

Figure A.9. Rib Technique at the Bedside: Thumb holds the shaft of the rib in a posterior direction.

Figure A.10. Eleventh and Twelfth Ribs: Middle finger acts as a fulcrum.

Rib Lesions Associated with Hyperextension of the Vertebrae

A distressing type of rib lesion is the one associated etiologically and pathologically with rather extreme extension of the spine. Produced during extension and perhaps sidebending with the convexity on the side of the lesion, the head of the rib is caught in a depression between the bodies of the vertebrae caused by a separation of the demifacets while in that position. This interferes with flexion and bending toward the side of lesion, which motions are painful. The involvement may be bilateral due to the rib being traumatically forced posteriorly or pulled by the pectoral muscles when the spine is hyperextended. Correction is made on one side at a time, and it sometimes is difficult of accomplishment. With the patient lying on the side opposite the lesion and in partial flexion, the operator stands in back of him. One hand draws the sternal end of the rib posteriorly, and the other lifts toward the lesioned side the spinous processes of the two vertebrae forming the costal pit. This rotates the bodies of the vertebrae away from the head of the rib, and the costotransverse articulation moves forward, the leverage lifting the head of the rib out of the

Figure A.11. Rib Lesions with Spinal Hyperextension: Two assistants elevate the shoulders.

depression between the demifacets. The ligaments are tensed to the proper degree and held for respiratory cooperation.

There is another method that is frequently successful in correcting rib lesions that are associated with hyperextension of the spine. The patient is seated, and his shoulders are lifted by two assistants, one on each side with a hand under the axilla, the patient's elbows remaining at his sides. This tends to open a gap between the demifacets and release the head of the rib. The lift should be just sufficient to tense slightly the intervertebral ligaments, and it is maintained while the operator proceeds with the respiratory technique for the rib involved.

PELVIC GIRDLE

The auricular surfaces of the sacrum and the ilium, covered by cartilage, lie more or less in sagittal planes, but flaring anteriorly and inferiorly. Their shape is that of a broad letter "L," the long arm being directed dorsoventrally, and from its anterior end the short arm extends cranially. Roughly following the line of this "L," there is usually a curved ridge on the auricular surface of the ilium which fits into a groove on the sacrum. They describe an arc around a transverse line running approximately through the spinous process of the first or second sacral segment. The arrangement of the ligaments is such that the sacrum can swing within limits between the ilia along the line of those ridges without materially changing the tension. Meanwhile the ligaments are limiting the tilt of the sacrum, downward and forward at the base and backward and upward at the apex, caused by the weight of the trunk through the lumbar spine when in the erect position. There is a notable absence of muscles between the sacrum and ilia which would control the motion of one upon the other.

Doctor Sutherland has called attention to an involuntary movement of the sacrum between the ilia in contradistinction to the postural mobility of the ilia upon the sacrum. This involuntary motion is associated with what is termed in his cranial concept as the "primary respiratory mechanism" which concerns a motility of the neural axis. The dural membranes, the cerebrospinal fluid, and the cranial bones and sacrum participate in this movement. The primary respiratory mechanism is fundamental to the pulmonary respiratory, the cardiovascular, and the various other systems of the body, so is not to be confused with diaphragmatic breathing. In the involuntary movement of the sacrum, its base alternately moves cranialward and recedes downward as a part of the primary respiratory mechanism. The inhalation or flexion phase of the movement causes the base to draw upward and the apex to move anteriorly, the sacrum swinging on the arc of the L-shaped auricular surface or the ridge and groove described above. Since this movement reduces the anterior convexity of the lumbosacral junction and since it bears no relationship to the movement of the sacrum as the trunk bends forward in the standing position, the term "respiratory flexion" is applied to it. "Respiratory extension" of the sacrum takes place when the base is lowered, the lumbosacral convexity is increased, the sacrum swings posteriorly in its arc and the apex moves posteriorly.

Postural or voluntary movement of the ilium upon the sacrum is familiar as the rotation of the innominate bone anteriorly or posteriorly on a transverse axis through the body of the second sacral segment.

Respiratory Lesions of the Sacrum

Diagnosis of sacral "respiratory" lesions is made with the patient in any position, usually seated. The thumbs or fingers of the operator bridge from the posterior superior spines of the ilia to the dorsum of the sacrum near the base, or from the posterior inferior spines to the contiguous part of the sacrum. The respiratory motion is accentuated by having the patient breathe deeply, and the freedom or limitation in the movement of the sacrum in its arc is palpated. The lesion may be either in the flexion position with limited movement of the sacral base forward and downward toward the extension position, or, vice versa, it may be unilateral or bilateral, or it may be in flexion on one side and extension on the other.

For the technique of correction, the patient is seated on the operator's knees or on a Ritter stool, facing the table. The patient's knees should be together and feet forward. The operator stabilizes the pelvis with a forearm against the anterior superior spines, and the patient bends forward to "walk" on the table with his elbows, or hands if necessary, away from his pelvic bones. This draws the sacrum anteriorly,

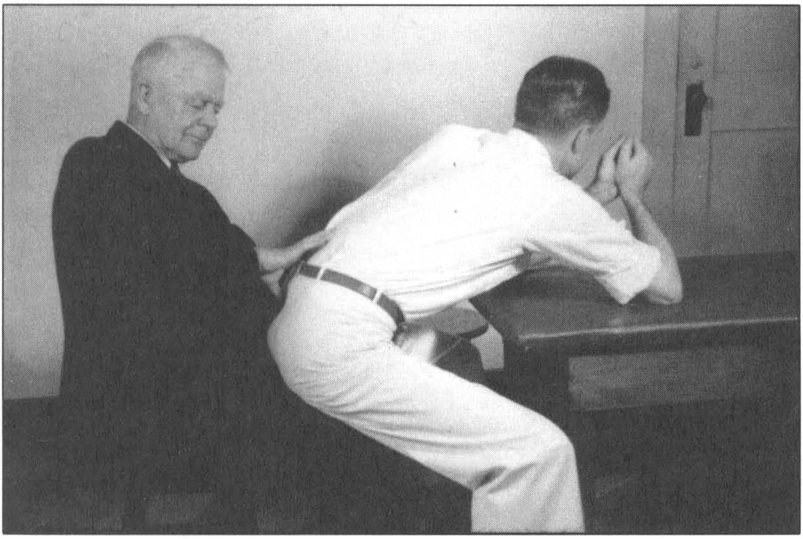

Figure A.12. Respiratory Flexion Lesion of the Sacrum

tending to disengage it from its wedged position between the ilia, causing it to be virtually suspended. It also releases the tension of the iliopsoas muscle.

Respiratory Flexion

If the lesion be of the "respiratory flexion" type, with the sacral base drawn upward and slightly posterior and the apex forward, the operator steadies the pelvis with the forearm on the side of lesion, avoiding a posterior pull upon it. The thumb of the other hand holds the apex forward, swinging the base upward and posteriorly for exaggeration of the lesion position. The patient then steps forward with his elbows or hands on the table, drawing the sacrum forward and, because of the flexed position of the lumbar spine, slightly downward from between the ilia. When the disengagement is palpated, the patient is instructed to walk back a short distance with his elbows to allow the sacral base to move posterosuperiorly and exaggerate the lesion position. The operator, with his knees, changes the position of the tuberosities of the ischia to find the point of balanced ligamentous tension, and holds for correction while the patient holds the breath in inhalation.

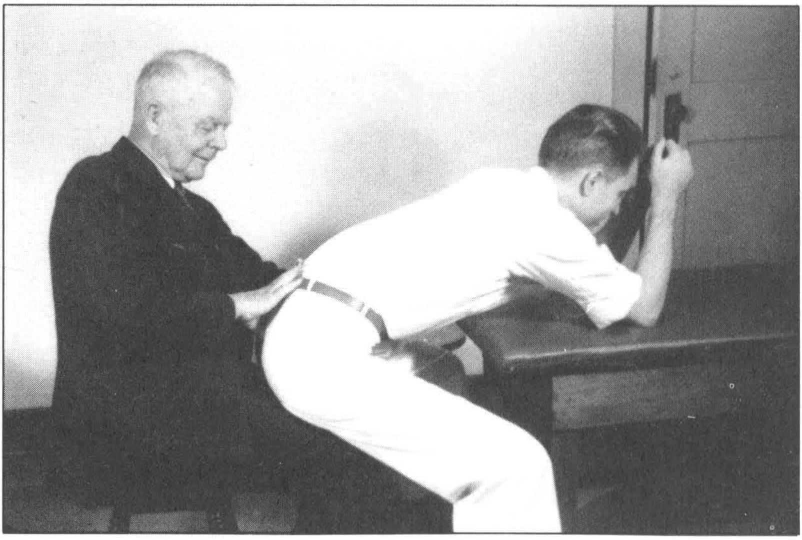

Figure A.13. Respiratory Extension Lesion of the Sacrum

Respiratory Extension

For "respiratory extension" lesions the operator holds the base of the sacrum forward and downward on the side of the lesion with his finger, and the apex posteriorly with his thumb under one side of the apex. The forearm on the side of lesion holds the pelvis posteriorly while the patient steps forward on the table with his elbows or hands. The proper point of balanced tension depends upon the amount of pull as the patient's shoulders move forward, the degree to which the lesion position is exaggerated by the operator's thumb and finger, and the relative position of the ischial tuberosities as they are moved by the operator's knees. Correction occurs with the patient holding his breath out as long as possible.

Bilateral

Bilateral flexion or extension lesions of the sacrum may be reduced with one procedure or on one side at a time. If the sacrum be rotated so that the ligamentous imbalance is toward flexion on one side and extension on the other, it is simpler to correct each side separately.

Postural Lesions

Postural sacroiliac or iliosacral lesions are diagnosed with the patient seated on the operator's knees. The tuberischia are alternately elevated and the motion between the sacrum and the posterior superior iliac spines is palpated. If the motion is free as the tuberosity is elevated and moved posteriorly and limited when moved the opposite direction, the ligamentous articular strain denotes anterior rotation of the innominate bone. Restricted motion when the tuberosity is moved backward and upward indicates a posterior rotation lesion. The diagnosis may be made with the patient seated on a Ritter stool, lowering the pelvis on one side or the other. The diagnostic motion or its limitation is elicited as the patient abducts the knees alternately.

Correction of the postural lesions is made with the patient standing, his hands on a stool which is placed on the table. The leg on the side of lesion is crossed in front of the other one and the foot rests on its outer edge, lateral to the one on which he stands. In this position the weight is transmitted from the spine through the sacrum to the innominate bone which is not directly concerned in the technique. The

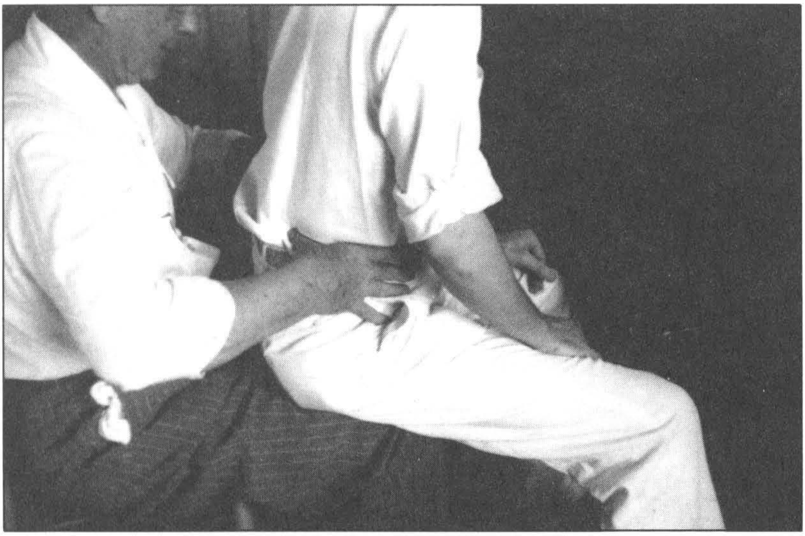

Figure A.14. Postural Sacroiliac, Diagnosis

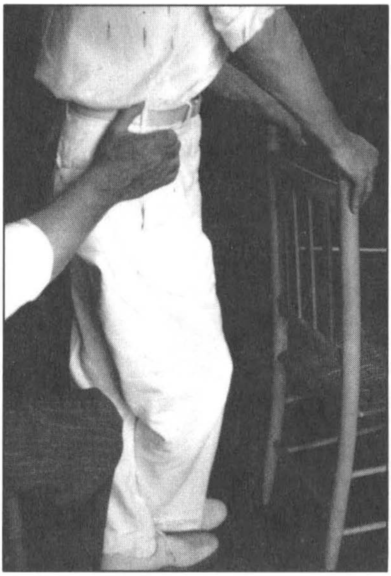

Figure A.15. Correction of Anterior Rotation of the Innominate: Operator rotates the ilium posteriorly on the sacrum.

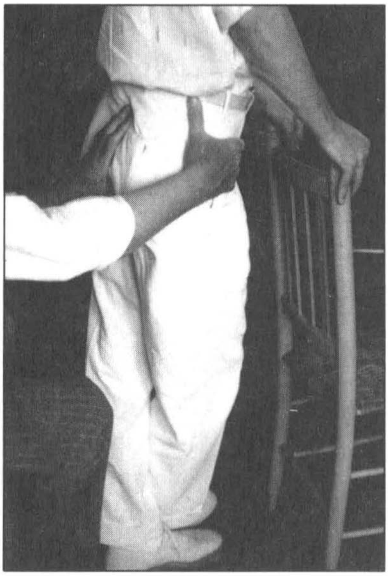

Figure A.16. Correction of Posterior Rotation.

sacrum is thus stabilized and the lesioned innominate is left suspended. The operator, sitting at the side of the patient, holds the tuberischium in the palm of one hand and the crest of the ilium in the other. The innominate bone is rotated with the hands, anteriorly or posteriorly toward the position of correction. (This is "direct action" technique, so if it is an anterior rotation lesion, the bone is held in posterior rotation, and vice versa.) The patient then flexes the knee which bears his weight to about 135 degrees, keeping the other leg relaxed, and returns to the erect position while the operator maintains the rotation of the innominate in the direction of correction.

Pubic Symphysis

The symphysis pubis is subject to ligamentous strain, frequently in association with sacroiliac lesions. There is an intervening cartilage between the pubes denoting motion. The bones are bound together by strong ligaments, some of whose fibres are diagonally placed, making them especially susceptible to strain or imbalance. An unevenness of the superior borders of the pubic bones may be palpated. The inferior ligament, extending between the inferior rami, is pierced by the urogenital ducts and by a branch of the internal pudendal nerve in close proximity to the symphysis, which is an indication of some of the symptoms that may be present.

A spreading or disengagement of the articulation is accomplished with the patient lying on the side with his thighs flexed. The operator stands in back of him. The tips of the index and middle fingers of the hand which is toward the foot of the table are placed between the inferior rami near the symphysis with a finger of the other hand between the proximal phalanges to act as a fulcrum or wedge to spread the tips of the fingers apart. This tenses the interpubic ligaments, and the tension may be balanced by advancing one or the other finger anterosuperiorly. The patient cooperates by pressing his knees together. A thick pillow between the knees is helpful. In the female patient, the thumb of one hand and fingers of the other are used to spread the symphysis.

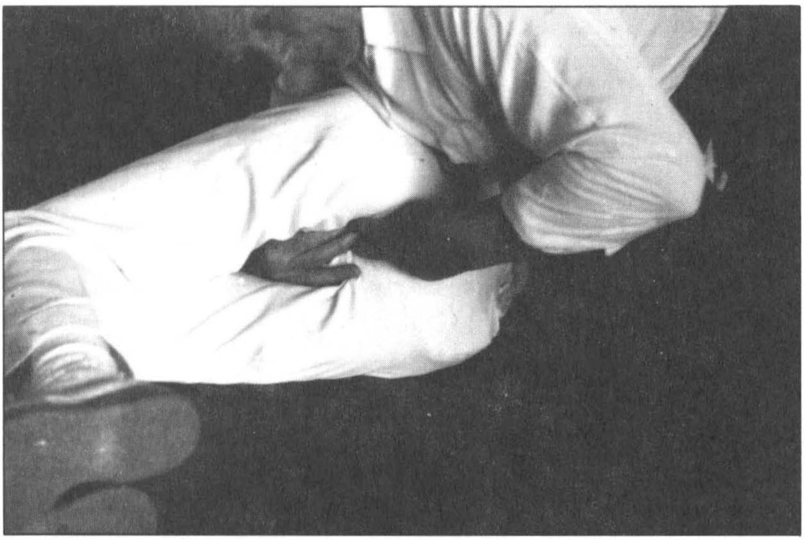

Figure A.17. Pubic Spread

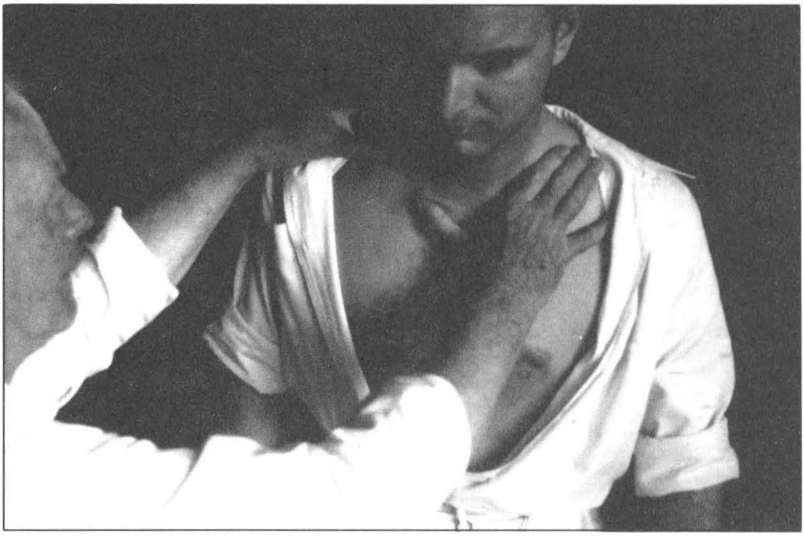

Figure A.18. Clavicle

UPPER EXTREMITY

Clavicle

The object of the technique for correction of lesions of the clavicle is to hold it cranialward and laterally while the patient lowers his shoulders and rotates the trunk, disengaging the sternal, costal, coracoid, and acromial articulations to tense their ligaments. The patient sits on the table, and the operator sits facing him, a thumb under each extremity of the clavicle. The fingers of one hand rest over the acromioclavicular junction for the purpose of palpation, and a finger of the other hand is placed medial to the sternal end of the clavicle to hold it laterally. The patient, with his arm on the involved side lateral to the operator's arm, rests his hand on the latter's shoulder. The patient drops his weight forward on the thumbs of the operator, who balances the ligamentous tension at the acromial end of the clavicle by carrying his shoulder and the hand resting on it backward away from the patient. Under direction, the patient draws his opposite shoulder posteriorly to move the sternum away from the clavicle and tense the ligaments at that articulation. The clavicle is balanced over the costoclavicular ligament, and the patient inhales and holds the breath for correction.

Humerus

Freedom of rotation of the humerus in the glenoid cavity is tested with the arm at an angle of 45 to 90 degrees laterally from the body, and the elbow flexed. Comparison of the motion on the two sides is made by carrying the hand laterally and upward to test external rotation of the humerus, and medially and downward for internal rotation. Restricted motion in one direction indicates lesion in the opposite position.

Correction is made with the patient seated, the operator standing on the side of lesion, facing him and with the hand which is toward the back of the patient palpating the shoulder joint. The other hand under the axilla, against the ribs and as close to the head of the humerus as possible, acts as a fulcrum for disengagement. The patient places the hand of the involved side over the distal third of the opposite clavicle and holds that shoulder. The internal rotation lesion is exaggerated by the patient elevating the elbow, external rotation by lowering it, the operator directing to the degree necessary to arrive at the point of balanced tension. The patient is instructed to move his uninvolved shoulder posteriorly, carrying with it the hand of the

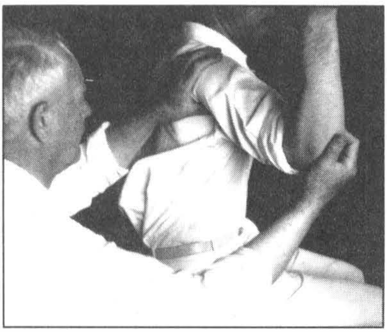

Figure A.19. Testing External Rotation of the Humerus

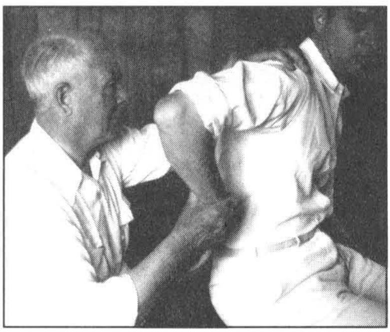

Figure A.20. Testing Internal Rotation of the Humerus lesioned side. This draws the lower end of the humerus across the chest in order that the leverage over the fulcrum provided by the operator's hand disengages the head of the humerus. Respiratory cooperation is then employed to correct the lesion.

Forearm, Wrist, and Hand

The bones of the forearm move in relation to each other on a double swivel. The proximal head of the radius rotates in the annular ligament, and the distal head around the end of the ulna. Little motion is possible between the humerus and ulna except flexion and extension. The capsular ligament of the elbow is composed of interlaced and confluent fibers that operate as a unit, and unbalanced tension may be caused by strain of the elbow joint or result from rotation lesions of the humerus. Strains which disturb the position of the olecranon process prevent complete extension of the arm, and those which affect the coronoid process prevent complete flexion. The semilunar notch between these two processes, which receives the trochlea of the humerus, opens anteriorly at about a right angle to the shaft of the ulna, but is frequently at an angle of more nearly 135 degrees.

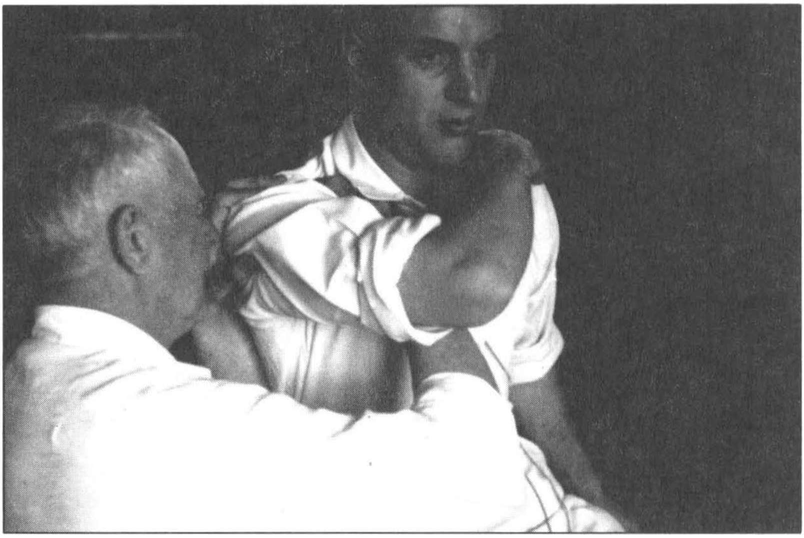

Figure A.21. Corrective Technique, External Rotation of the Humerus

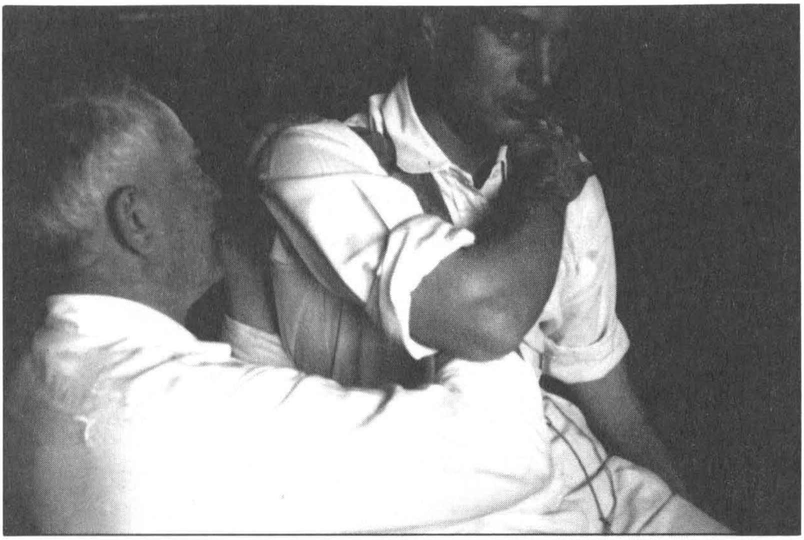

Figure A.22. Corrective Technique, Internal Rotation of the Humerus

Ulna

The corrective technique for ulnar lesions is applied with the patient seated facing the table, elbow flexed to about 90 degrees, and his hand, palm down, on the table. The fingers are spread as widely as possible to release the metacarpals and the distal row and possibly all of the carpal bones. The operator sits on the side of lesion and rests his fingers over the dorsum of the carpus and proximal ends of the metacarpals, and the thumb on the styloid process of the ulna for palpation. The fingers of the other hand grasp the olecranon process. The patient inverts and everts the humerus, raising and lowering the elbow, while the operator finds the direction in which the motion is limited and determines the point of balanced ligamentous tension. The operator then holds the proximal end of the ulna away from the humerus by means of the olecranon process, or the patient may steady the wrist with his other hand while the operator holds both the olecranon and coronoid processes, tending toward rotation of the ulna to the proper degree. The patient then raises his shoulder to draw the humerus out of the semilunar notch of the ulna for release and correction. The direction of the pull

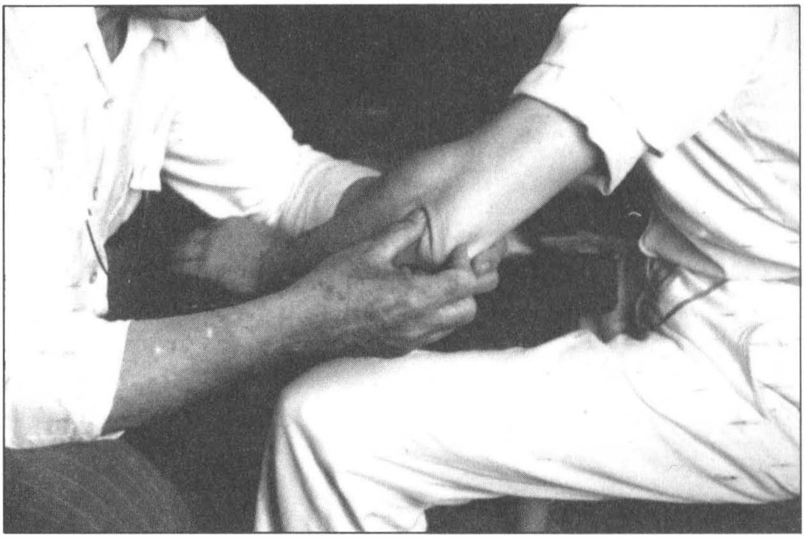

Figure A.23. Ulna

on the humerus may need to be at an angle greater than 90 degrees to prevent binding on the olecranon process, the operator's sense of touch deciding that point.

Radius

Lesions of the head of the radius prevent free supination or pronation of the forearm. For correction the position is similar to that for ulnar lesions, except that the patient's elbow is only slightly flexed. The operator holds both ends of the radius with his fingers, palpating for the ligamentous imbalance as the patient circumducts his elbow upward and downward and medially to rotate the humerus in relation to the radius. When the point of balanced tension is found, the radius is held firmly by the operator for stabilization, and the patient circumducts the elbow a little farther for exaggeration and correction.

Wrist and Hand

In dealing with lesions of the wrist and hand it is well to remember the intercommunicating articular cavity of the joints and the dorsal convexity of the arch formed by the wedge-shaped proximal heads of the metacarpal bones, narrowed on their volar aspect. The patient sits with his hand on the table, palm down and fingers spread. Facing him, the operator holds downward the dorsum of the distal end of the metacarpal with his thumb, and he lifts and separates the proximal heads of that and the metacarpal on either side of it with the ball of his middle finger, placed under the palm between the proximal ends of the shafts of the bone being held by the thumb and of the one on either side. When the metacarpals are lifted dorsally and separated they are also rolled on their long axes. The operator's other hand on the dorsum of the wrist stabilizes the carpal bones. With this procedure the restriction is found and the ligamentous tension is brought into balance and held. Then the patient spreads his fingers more widely to disengage the lesioned articulation for correction. Lesions of the carpal as well as the metacarpal bones may be reduced by this technique. The procedure is completed by the operator holding and rotating on their long axes the involved fingers, one at a time, while the patient, keeping his fingers widely spread, slowly withdraws his hand, raising and lowering his elbow.

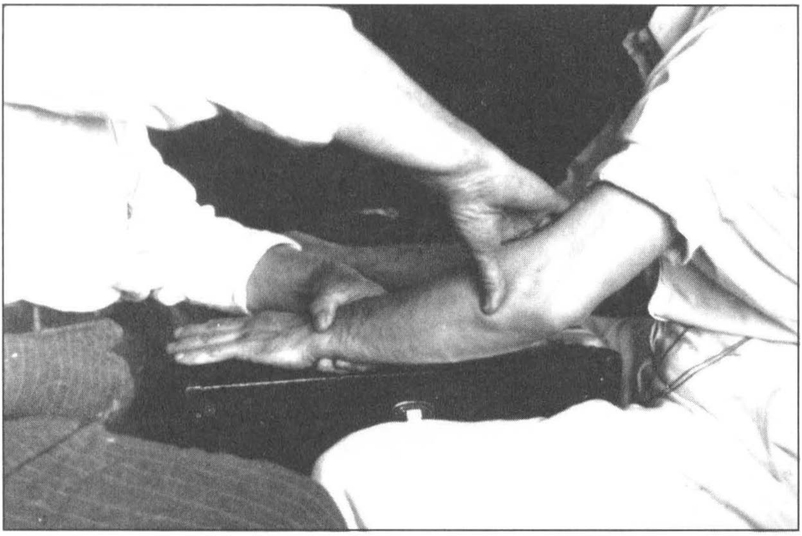

Figure A.24. Radius

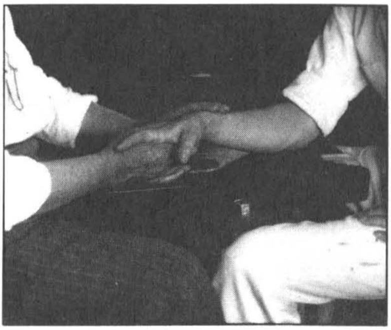

Figure A.25. Wrist

Figure A.26. Hand

Dr. A. T. Still used his flexor profundus digitorum muscles in correcting lesions of the wrist and hand. He interlaced his fingers with the patient's wrists between his palms. The patient spread and extended his fingers, making the back of the hand as nearly concave as possible. Varying the pressure by means of the flexor profundus digitorum

Figure A.27. A. T. Still's Wrist Technique muscles, Dr. Still found the point of balance at the exact location of the lesion and allowed the bones to spring back into normal relationship as the patient relaxed his hand.

LOWER EXTREMITY

Hip Joint

The capsular ligament of the hip joint is strong, comparatively lax, permits a wide range of motion, and is frequently subject to strain. Diagnosis of lesions of this articulation is made with the patient standing, the weight on one foot. Without turning the pelvis, he rotates the leg that is not bearing his weight, pointing the foot laterally and medially to determine the degree of external and internal rotation of the head of the femur in the acetabulum. Comparison of the motion in either direction on the right and left sides designates the lesion. In another method of diagnosis, the patient is seated on the table with one leg resting over the other knee. The operator, facing him, holds the leg at the knee and ankle and rotates the femur in question by tilting the leg in either direction over the knee on which it rests. Restrictions caused by exostosis or other bony abnormalities are usually indicated by a less resilient limit of motion than is present in ligamentous articular strains.

For the corrective technique, the patient sits across the table with the uninvolved hip next to the end. The leg of the lesioned side is crossed over the other knee, resting midway of the shaft of the fibula. The operator sits at the end of the table, one hand medial to the shaft of the involved femur near its head, holding it laterally. The other hand reaches around in back of the pelvis to palpate the motion at the greater trochanter.

In the case of an external rotation lesion, the patient holds his knee laterally and downward with his hand for exaggeration, sidebends and rotates his body away from the lesioned side and leans backward. The operator firmly maintains his fulcrum against the shaft of the femur and determines the point of ligamentous balance. The correction occurs with exaggeration of the lesion position and disengagement of the articulation.

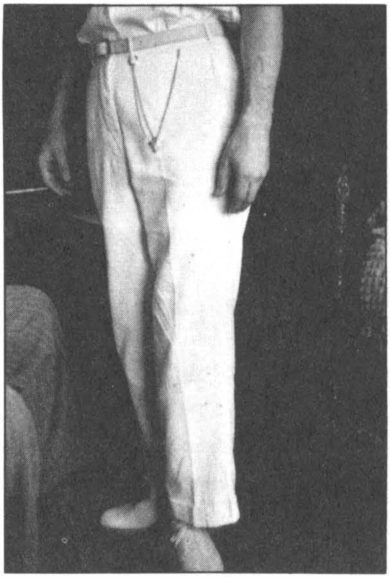

Figure A.28. Testing External Rotation of the Femur

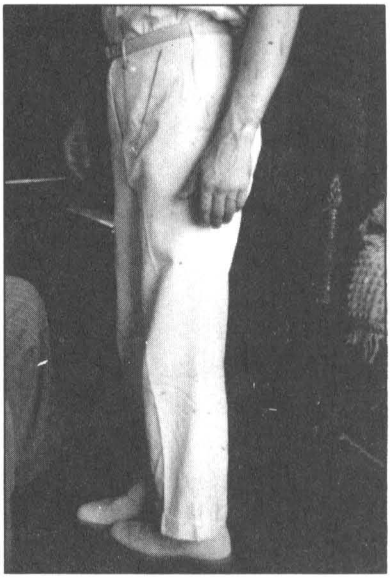

Figure A.29. Testing Internal Rotation of the Femur

Internal rotation lesions are corrected with the operator holding the fulcrum on the femur more proximally than in the former technique and palpating for ligamentous balance with the other hand at the greater trochanter as above. The patient draws his knee medially and upward with his hand, leans forward and sidebends and rotates the body toward the side of lesion for exaggeration to the proper degree.

Dr. A. T. Still used a similar technique in which he sat on the patient's uninvolved thigh and the leg on the side of lesion crossed over Dr. Still's knee. The principle of exaggeration and fulcrum disengagement was used for correction.

Tibiofemoral

Tibiofemoral lesions, sometimes referred to as dislocated semilunar cartilage, are caused by a sudden or forcible rotation of the tibia in relation to the femur, usually in conjunction with a sidebending strain upon the knee. In a majority of instances, the medial condyle of the tibia has been rotated anteriorly when the foot was turned laterally and the knee bent medially, the lateral articulation of the knee joint having acted as a fulcrum. History of the injury, location of the tenderness, inability to fully extend the knee in most cases, pain and restriction on attempting to reverse the lesion position, and palpation, establish the diagnosis.

For correction, the patient is seated with the involved leg balanced over the opposite knee. Facing him, the operator places one hand on the knee and grasps the foot, just below the ankle, with the other hand. If the lesion be of the medial condyles, the operator provides a fulcrum on the lateral condyle of the tibia with his thumb, one or two fingers are on the medial condyle of the femur for palpation, and the knee is carried medially and upward, tipping the foot laterally and downward, to disengage the lesioned joint surfaces and tense the ligaments. The tibia is rotated externally or internally by the other hand at the foot to exaggerate the lesion position to the point of balance. The patient is then instructed to resist the turning of his foot and the result of that effort is to glide the medial condyle of the femur into its proper position on the tibia. When the lateral condyles of the knee joint are involved, the fulcrum is on the medial condyle of the tibia, the articulation is disengaged by tipping the leg over the knee on which it rests so the knee moves downward and the foot upward. Exaggeration of the lesion position by rotation of the foot and the correction by the cooperation of the patient in resisting that movement follow the same principle as is used in lesions of the medial condyles.

Figure A.30. Testing External Rotation of the Femur

Figure A.31. Testing Internal Rotation of the Femur

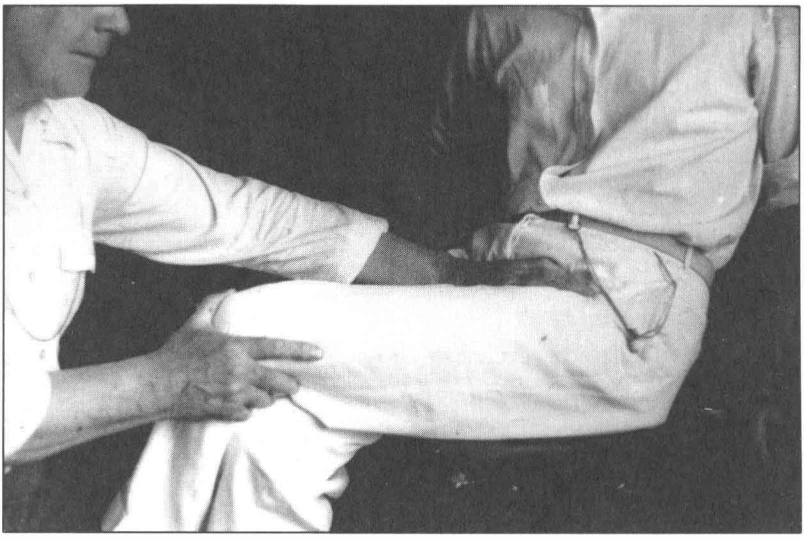

Figure A.32. Corrective Technique, External Rotation of the Femur, Variation from the text.

Figure A.33. Corrective Technique, Internal Rotation of the Femur, Variation

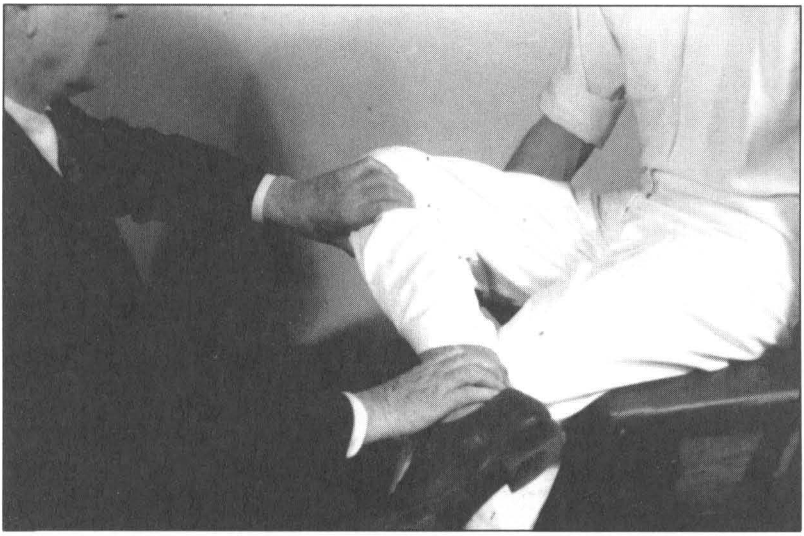

Figure A.34. Tibiofemoral

Fibula

Most lesions of the fibula affect both its proximal and distal articulations and cause added tension through the interosseous membrane which is in close proximity to the vessels of the leg. Tenderness, disturbances of the ankle joint and circulation of the foot, and limited motion of the fibula in relation to the tibia give evidence of the lesion. For correction the patient sits with his leg, near the ankle, over the other knee. The operator holds both ends of the fibula anteriorly with his fingers to the point of balanced tension of the ligaments. The patient dorsiflexes and externally rotates the foot and presses downward on the knee or lifts it upward and medially with his hand. This rotates the fibula and releases it at both ends from the tibia and from the astragalus. Further disengagement and correction are accomplished by the patient drawing the leg backward away from the operator and moving it lengthwise of the fibula as the operator holds that bone anteriorly with his fingers.

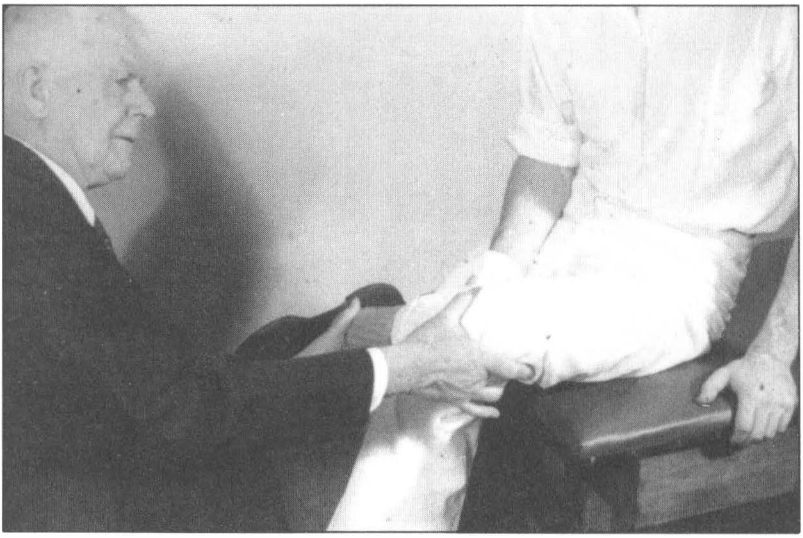

Figure A.35. Fibula

Tarsal Arch

Following the fibular correction, an effective technique for lifting the tarsal arch is performed with the operator at the foot of the patient. The fingers are interlaced over the dorsum of the foot, and the crossed thumbs on the plantar surface hold the internal cuneiform and cuboid apart to spread the arch and exaggerate the transverse flattening to the point of balanced tension. For correction the patient, with his foot in plantar inversion, dorsiflexes and then plantar flexes it against the resistance of the operator's thumbs.

Tibio-Calcaneo-Astragalus

Lesions of the complex articular structure of the foot are corrected by a method contrived by Dr. Sutherland based on the beneficial effects of removing a tight boot by means of the old-fashioned bootjack. Each time the device was used, the user gave himself a foot treatment.

Characteristic of the fallen arch are the anterior position of the astragalus between the malleoli and in relation to the calcaneus, and

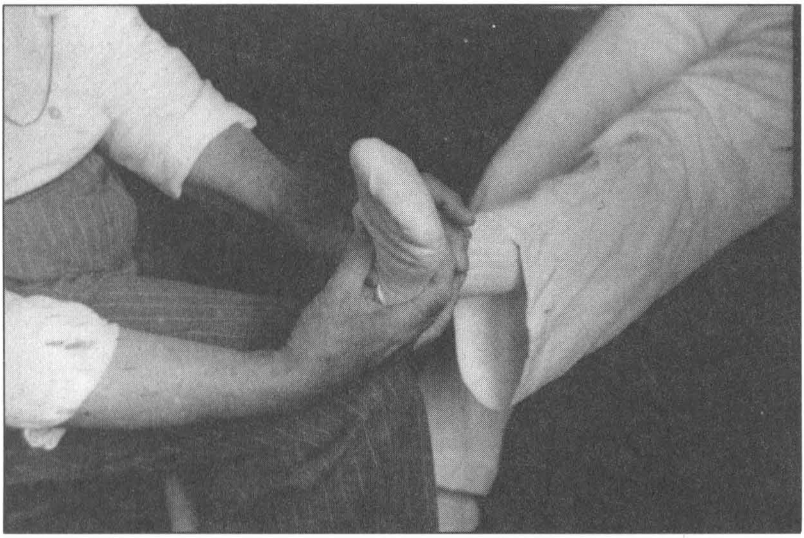

Figure A.36. Tarsal Arch

Figure A.37. Preparatory to "Bootjack" Technique

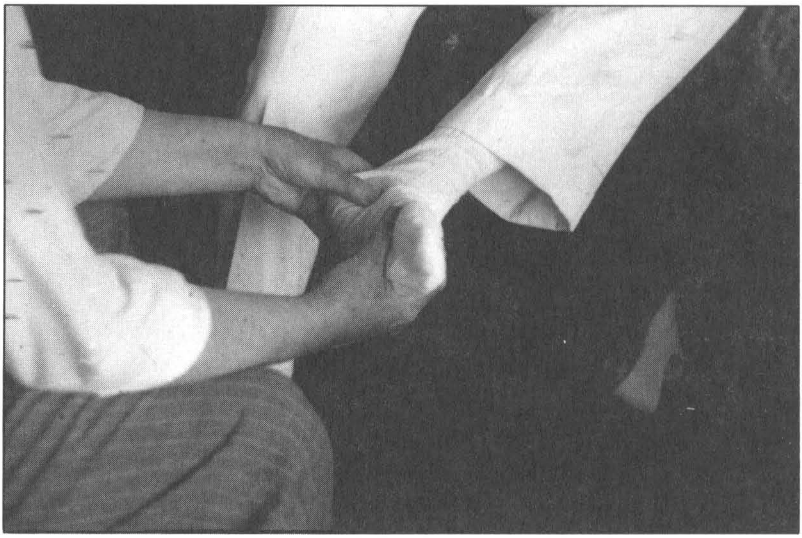

Figure A.38. Tibio-Calcaneo-Astragalus

the lowering of the calcaneus anteriorly, of the medial part of the cuboid, and of the longitudinal and transverse arches. The technique, like the operation of pulling the foot out of the boot, lifts and moves the structures back into their normal relationship.

In preparation for the corrective technique, the patient or the operator holds the tuberosity of the calcaneus and the metatarsals medially with the fingers. The thumbs on the inner side of the foot at the junctions of the calcaneus with the talus and the navicular with the internal cuneiform lift those structures laterally and upward, bending and stretching the foot around the thumbs. Following that procedure, the patient drops the foot and ankle into plantar flexion, and the operator places between two of the toes the web of the thumb of the hand that is toward the lateral side of the foot. The thumb holds the dorsum of the distal heads of the metatarsals downward, and the middle finger of that hand under the shafts of the metatarsals rolls them on their long axes and lifts and separates the proximal heads, which are wedge-shaped and narrowed inferiorly. This releases the metatarsal and the distal row of the tarsal bones. The fingers of the other hand grasp the posterior part of the calcaneus and hold it medially and downward while the thumb lifts laterally and upward on the inferomdial aspect of the cuboid. The operator rotates the anterior part of the foot internally and externally to balance the ligamentous and fascial tension, and continues to hold medially and downward on the tuberosity of the calcaneus while the patient draws on the achilles tendon for exaggeration and correction.

Astragalus, Calcaneus, Tarsal Arch

Another useful procedure in the release and correction of tarsal lesions, especially the astragalus, makes use of the fact that strong dorsiflexion of the foot elevates the arch. The operator interlaces his fingers in back of the heel and with his palms holds the astragalus and calcaneus firmly in the position they would take in extension of the ankle joint. The patient dorsiflexes and inverts and everts the forepart of the foot against the resistance provided by the operator.

NON-OSSEOUS STRUCTURES

Soft tissue treatment in osteopathy has been frowned upon since the early days when Dr. A. T. Still referred to some types of it as "engine wiping." It has been associated in the minds of many of us with rubbing or massage, yet intelligent and scientific adjustment of non-osseous structures is as truly osteopathic as correction of bony lesions. Dr. Still regarded the body as a complex unit composed of interrelated parts working in harmony, each endowed with the inherent desire, intelligence, and ability to perform its function according to the plan of a Master Mechanic. When circumstances prevent any part of the body, whether bony or soft tissue, from doing so, the effects are far-reaching. Perfect health ensues when each part is in perfect adjustment and free to do its work. Dr. Still had the greatest respect for the humours and the fasciae, the nerves, vessels, viscera, and all the other elements that compose the body. He had a remarkable faculty of being able to locate maladjusted tissue, of associating cause with effect, and tracing effects back to cause. That quality is reflected in Dr. Sutherland's technique.

Figure A.39. Cervical Fascia, First Position

The fasciae envelop, separate, protect, and support the various structures. Not the least important of their functions is to encourage and direct the movement of tissue fluids and to promote the flow of lymph through its channels. The various layers of fascia interconnect and present a continuity from head to foot. Dr. Still recognized "drags" on the fasciae which are caused by hypotonicity, the weight of viscera, strains, and posture. Treatment to restore the normal tension, hence function, of the fascial system is extremely effective.

Anterior Cervical Fascia

The anterior cervical fascia is attached to the base of the skull, the mandible, hyoid, scapula, clavicle, and sternum. Through the pretracheal, it is connected with the fibrous pericardium, and thence with the diaphragm. It surrounds the pharynx, larynx, and thyroid gland; it forms the carotid sheath; and by way of the prevertebral fascia is connected with that which surrounds the trachea and esophagus. Therefore, the cervical fascia is concerned quite directly with lymphatic drainage of the head, neck, thorax, and upper extremities. Not

Figure A.40. To Lift the Cervical Fascia

only voluntary movements, but respiratory activity, is a factor in this vital function of the fascia, moving it forward in exhalation and backward in approximation to the spine during inhalation. Restoration of free movement of the deep cervical fascia renders unnecessary much of the soft tissue treatment of the neck and helps in overcoming intrathoracic congestions.

The "drag" on the cervical fascia is eliminated by having the patient seated on the table or side of the bed facing the operator. His body is flexed, and his head hangs forward. The operator directs his thumbs posteriorly and downward over the clavicle just lateral to the attachment of the sternomastoid muscles. With the arms lateral to those of the operator, the patient rests his hands on the shoulders of the operator and slowly drops his weight forward. This advances the thumbs down into the mediastinum just anterior and to either side of the trachea. The operator approximates his thumbs enough to gently hold the pretracheal fascia while the patient slowly assumes the erect posture, but with the neck remaining in flexion. It is unnecessary to go so deep into the mediastinum as to be uncomfortable to the patient. This technique lifts the fascia and reduces the "drag" from below.

Diaphragm

Because of its relationships, the diaphragm deserves consideration other than as a muscle of respiration. The pericardium is firmly attached to it above, the peritoneum below, and the great vessels and the esophagus pass through it. Being rather closely associated with the organs of respiration, circulation, and digestion, it is important that the full excursion of the diaphragm be unimpeded. This is prevented by a "drag" on the abdominal fascia and may be restored by a technique known as the diaphragmatic lift. The object of the treatment is to draw the diaphragm cranially, elevating the floor of the thorax, drawing upward on the abdominal contents, and promoting venous and lymphatic drainage from the lower half of the body. Visceroptosis and even internal hemorrhoids respond to it.

With the patient supine, the operator introduces his fingertips under the costochondral junctions. If that area is particularly sensitive, the patient hooks his own fingers under them, and the operator lifts on his hands. As the patient exhales, the operator lifts the lower rim of the thorax in a cranial and slightly lateral direction. The advancement that is made is held during inspiration and is increased on exhalation.

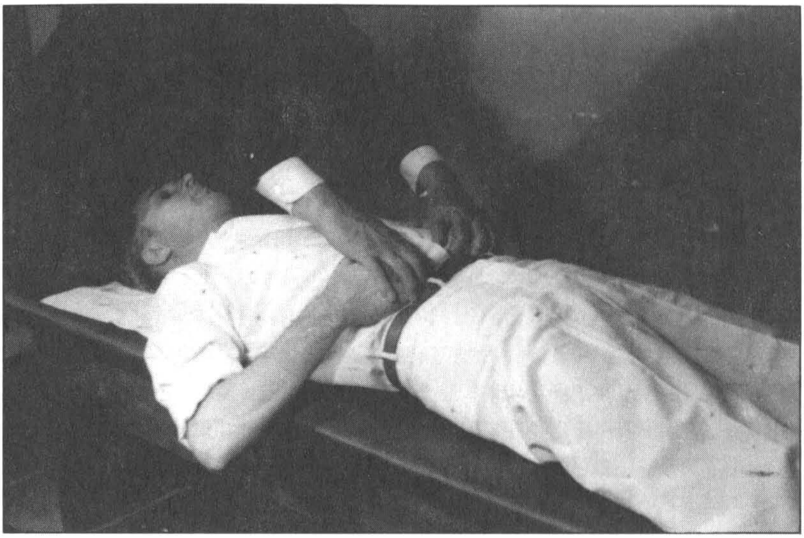

Figure A.41. Diaphragmatic Lift

The patient is instructed not to hold the breath in, but to exhale immediately after inhalation. After several respiratory cycles there is no further upward progress and the patient is told to breathe out, close the throat and attempt to expand the chest.

Arcuate Ligaments

In a technique utilized for relaxation of the external arcuate ligaments, the tension affecting the important structures passing through

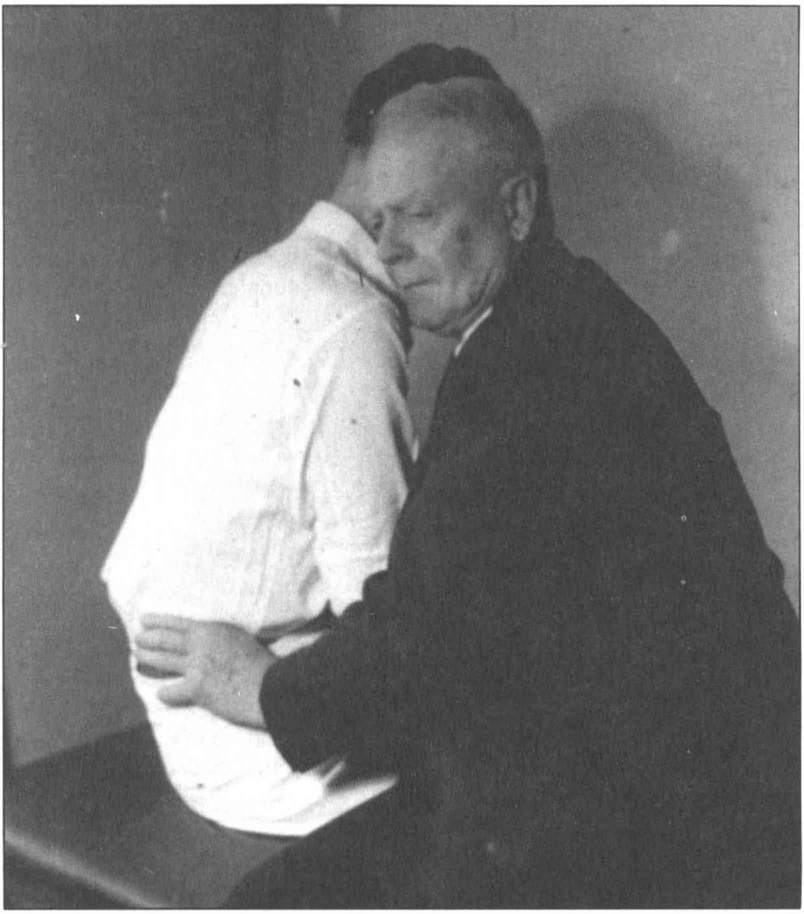

Figure A.42. Arcuate Ligaments

the arches of the diaphragm is relieved. The patient seated, the operator facing him from the front or at his side, starts his thumb under the twelfth rib just lateral to the erector spinae mass. The right thumb is used for the left side of the patient and vice versa. The patient bends his trunk over the operator's thumb, which gently and gradually advances upward and posteriorly as the patient exhales, and holds its position as he inhales. When the thumb arrives at a point against or under the ligament, it is drawn laterally with a rolling motion which relaxes the external and often influences the internal arcuate ligament.

Liver Turn

A treatment to stimulate the liver to increase activity is given with the patient lying on his back. The operator inserts the ends of the fingers of the right hand between the inferior border of the right costal cartilages and the liver. The fingers of this hand should be slightly flexed with the dorsum resting against the anterior border of the liver. The left hand placed over them presses them downward, holding the anterior border of the liver in a medial and caudal direction, while the patient inhales and holds the breath. The diaphragm holds the body of the liver caudally until, on the sudden exhalation, it elevates. Since the anterior border is still held downward by the fingers, the liver makes a turning movement probably attended by suction within its substance.

Biliary Drainage

In another treatment for sluggish liver, the patient is seated and the operator holds his thumb firmly in the right hypochondrium. The patient leans slightly forward and rotates the body to the left, causing the thumb to advance further toward the inferior surface of the liver. Closing his throat, he attempts to inhale after the manner of the military order, indelicately expressed as "suck in your guts." This drains the bile passages and the pancreatic duct.

Abdominal Treatment

Treatment directly over the abdomen should be administered carefully and with due respect for the viscera within. To lift and hold the sigmoid flexure or raise the cecum from the pelvic bowl, the fingers of

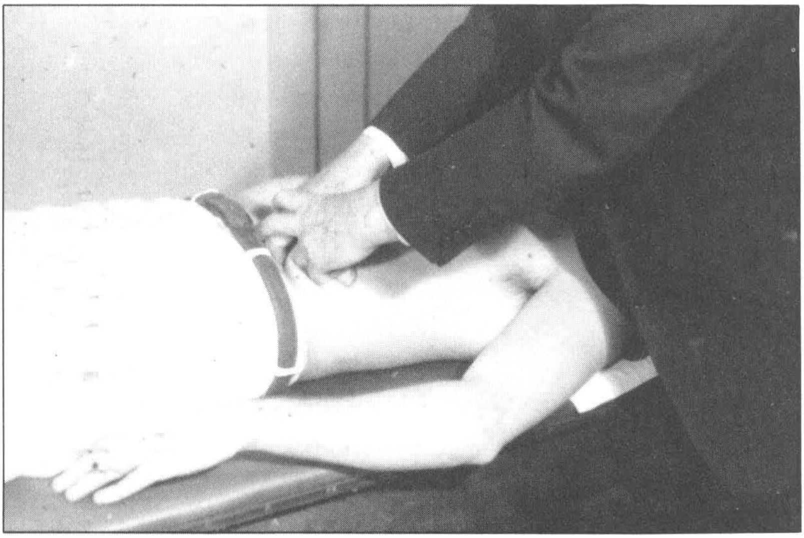

Figure A.43. Liver Turn

one hand are introduced close to the ilium and are supported and slowly lifted by the other hand. This permits use of a keen, tactile sense and the ability to employ the various fingers as needed to restore proper peristalsis, circulation, or drainage. Intestinal activity may be increased by holding the left eleventh rib downward and medially to limit its excursion during two or three respirations. The false ribs may be treated similarly: Dr. Sutherland reported the passage of gall stones without pain when the tenth rib on the left was held in that manner. The effects are produced by way of the sympathetic chain lying in close proximity to the heads of the ribs.

Psoas Muscle

Contractures of the psoas muscles exist in varying degrees, from acute spasm to the mild cases which escape recognition. Usually the patient is more comfortable with the thighs and the lumbar spine flexed upon the pelvis, there is difficulty in arising directly from the supine to the sitting position, and pain is referred down the leg because of irritation of the nerves of the lumbar plexus passing through the belly

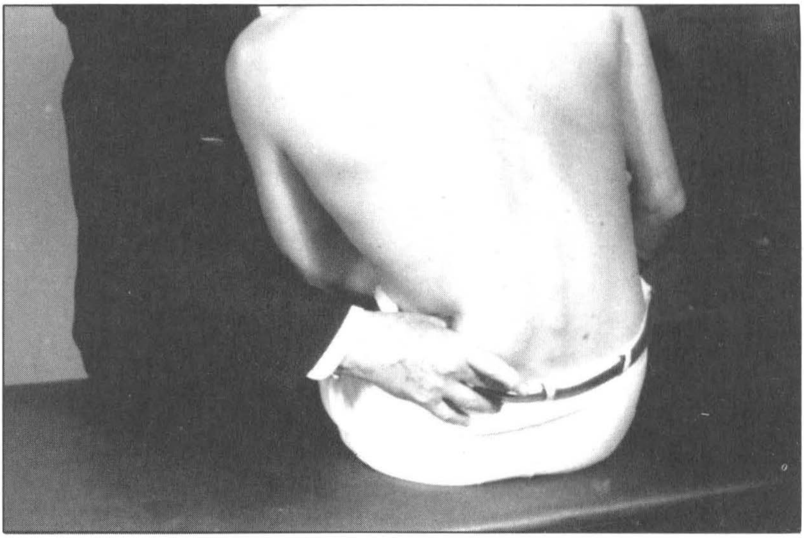

Figure A.44. Psoas Muscle

of the muscle. The psoas fascia has a connection with the diaphragm by way of the internal crus, indicating a restricting influence upon the excursion of the diaphragm. The course of the ureter is on the medial side of the psoas major, and the technique for relaxation is an aid to the passage of renal stones since the hand of the operator almost reaches the ureter. The kidney, cecum, descending colon, and small intestines rest upon the psoas and are affected by the technique which lifts the muscle out and free from the underlying nerve ganglia and vascular channels.

With the patient seated, the operator places his thumb along the crest of the ilium, pointed posteromedially, and rolls it over the crest into the iliac fossa. The thumb is held firmly in a medial, posterior and slightly caudal direction, following the internal surface of the ilium while the patient bends his body to bring the psoas muscle in approximation with it. The operator is seated in front of the patient who bends and leans laterally and forward to "put the glove on the thumb." The patient may rest his arms on the operator's shoulders in which case he leans forward, causing the thumb to advance to its position against and posterior to the psoas major, lifting the muscle forward. The patient then inhales deeply, holds the breath, and on exhalation straightens the trunk as the operator releases his pressure on the muscle. If the patient is bedfast, he lies on his side with a pillow under the shoulder to produce the sidebending, the rest of the technique following the principles of that described above. When the treatment is given for its influence upon the cecum, a chronic appendix, colon, small intestine, kidney, or ureter, the psoas is held forward while the patient rotates his thigh alternately internally and externally. In the bedside technique this is done with the patient more or less in the Sims's position, lifting the knee laterally and lowering it to the bed.

Iliopsoas Tendon

The iliopsoas tendon may be lifted or stretched by holding it forward at a point just proximal to the lesser trochanter, the patient lying on the back. This treatment relieves the anterior tension upon the spine in lordosis, gives relief in the passage of renal calculi, and is an effective measure for sciatica.

Pelvic Lift

The fascial connections from the neck to the diaphragm have been mentioned. The direct attachment of the diaphragm to the liver and the connections to the stomach, duodenum, psoas, and peritoneum complete a chain embracing the viscera all the way down into the pelvis. Fascial "drag" has an adverse influence on the support and function of the organs and on the circulation and drainage of the lower half of the body. The aorta lies against the bodies of the vertebrae and is crossed anteriorly by the crura of the diaphragm. Thus the "drag" on the crura has a constricting effect upon the aorta, throwing an extra load upon the heart and predisposing to cardiac insufficiency. Dr. Still described this phenomenon with the parable of the goat and the boulder. The boulder represented the crura, the path was the aorta, and the valves of the heart were the tail, the heels, and the whole goat. "The goat, finding the boulder in its path, backed up and gave it a butt and his tail went up. Not to be outdone he backed up

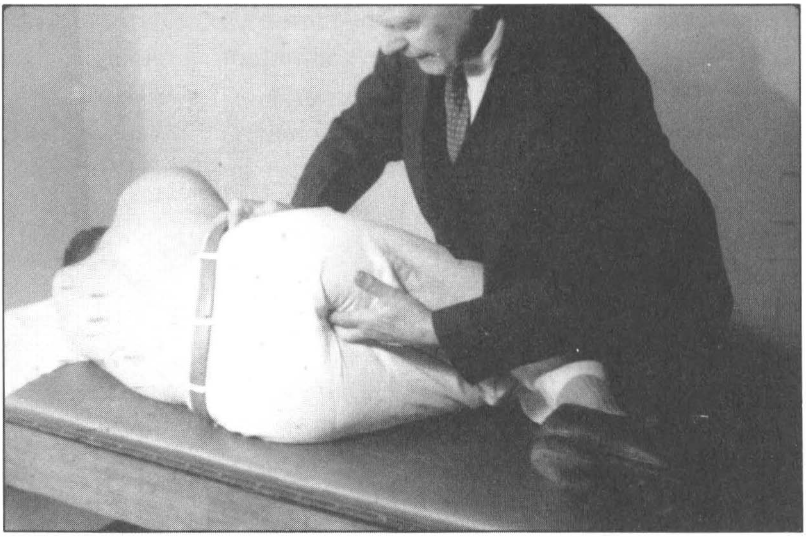

Figure A.45. Pelvic Lift

further, came a-running and gave it another butt and his tail and heels went up. Then he backed up further and with a supreme effort gave it another butt and the whole d— works went up."

An effective technique for reducing the "drag" on the fasciae is applied with the patient lying on the left side. His thighs are straight and slightly flexed to the position in which the floor of the pelvis is most relaxed. The operator stands in back of him and starts the tips of the fingers medial to the right tuberischium and advances them upward between the obturator membrane and the rectum while the patient exhales. During inhalation the position of the fingers is held gently, but firmly, not allowing them to recede. This hand may be supported by the other hand to allow the fingers to hold more steadily and to note more carefully the resistance of the tissues. After several cycles of deep respiration, the resistance will be felt to diminish suddenly and the tissues spring upward in advance of the fingers.

This technique is adaptable to the various pelvic prolapses that are bound to cause a drag on the fascia and that persist partially because the support of that agency has been reduced. The fingers may be directed cranially and medially or anteriorly toward the cecum, uterus, bladder, or prostate for specific effect upon those organs. It will be found easier and less uncomfortable to the patient than local treatment. If indicated, the technique may be applied to the left side of the pelvis.

Popliteal Drainage

Movement of fluids from the popliteal space and below may be accelerated by drawing apart the tendons of the biceps and semi-tendinosus muscles, just above the knee. The patient is supine with his knee slightly flexed, and he alternately presses against the table with the heel and relaxes. The effort to flex the knee tends to compress the tissues of the popliteal space, and it expands when the patient relaxes the leg and the operator separates the tendons. The effect is that of a booster pump in the return of the fluids toward the heart.

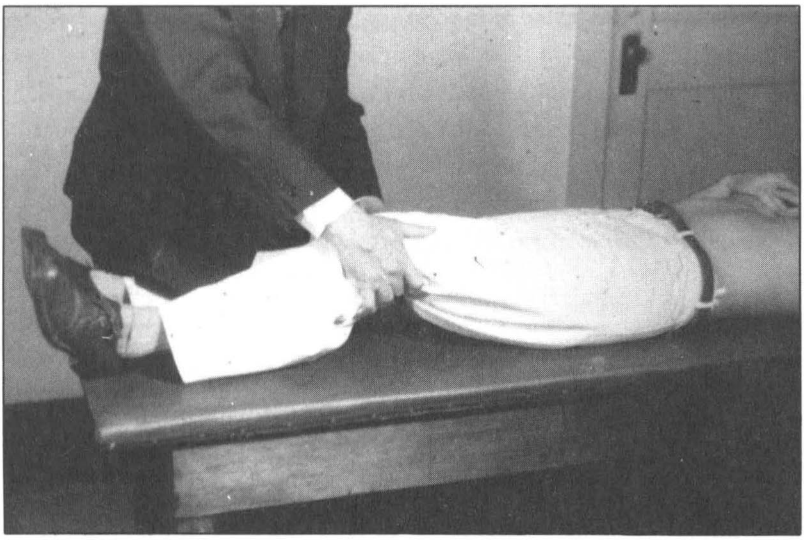

Figure A.46. Popliteal Drainage

CONCLUSION

The osteopathic articular lesion, being primarily an unbalanced tension of the ligaments with strain as the usual cause, is corrected mainly through the agency of the ligaments themselves. The natural tendency of the body is to revert to normal when the balance is restored and the factors preventing the return are removed. It will be noted that as a rule gliding separation of the joint surfaces is used to tense the ligaments in vertebral, sacroiliac, carpal, and tarsal lesions. Fulcrum leverage for disengagement is employed in lesions of the long bones, combined with exaggeration of the lesion position in those of the extremities. The principle of the fascial treatment is to lift the fascia at its more dependent part, the patient cooperating.

Dr. Sutherland's technique seems a radical departure to most of us. It avoids the familiar thrusting and popping of joints. However, it is based upon the fundamental principles of osteopathy as conceived by Dr. Still and accords with his admonition that osteopathic technique should be gentle, easy, and scientific.

GLOSSARY

The definitions and descriptions of these selected words are for the convenience of the reader. The selections were made so as to convey the sense in which Dr. Sutherland used them. The definitions were taken from standard dictionaries, medical dictionaries, and medical texts.

AMERICAN SCHOOL OF OSTEOPATHY: The college established by Dr. Andrew Taylor Still in 1892 in Kirksville, Missouri. It was merged with the Andrew T. Still College of Osteopathy and Surgery in 1924 to become the Kirksville College of Osteopathic Medicine.

AUTOMATIC, SHIFTING SUSPENSION FULCRUM: The name given by Dr. Sutherland to a functional area in the straight sinus around which the reciprocal tension membrane operates.

Automatic – operating by itself; functioning mechanically
Shifting – changing or moving from one place to another
Suspension – the state of being suspended, as in a suspension bridge in which a roadway is hung across a stream
Fulcrum – *Mech.* point on which a lever turns; means by which influence is brought to bear

BALANCE: a) The normal state of action and reaction between two or more parts or organs of the body. b) Scales – A weighing apparatus with central pivot, beam, and two trays. c) The regulating gear of a clock or watch.

"BE STILL AND KNOW": Biblical quotation from Psalm 46:10 to point to the need for the operator's stillness before an action.

"BENT TWIGS": A phrase used by Dr. Sutherland to refer to the saying, "As the twig is bent so is the tree inclined." This saying implies a profound truth that applies to the human infant as well. Because the bones of the cranium are in parts at birth, degrees of disarrangement among them may occur. Such modest strains may become large with growth to maturity.

BEVEL: The incline that one surface or line makes with another when not at right angles.

BRACHIUM PONTIS: Also named the middle cerebellar peduncle. In relation to the functioning of the primary respiratory mechanism, Dr. Sutherland envisioned these brachia as arms extending out from the cerebellum to the pons lifting the brain stem, causing the shape of the fourth ventricle to rhythmically change.

BREATH OF LIFE: Dr. Sutherland's quotation from the Bible that he used frequently to point out that he was not speaking of the breath of air. ("And the Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life and man became a living soul." Genesis 2:7, King James Version)

BREECH PRESENTATION: When the lower part of the body of the fetus (buttock or leg) is in advance during birth. The presentation may be incomplete. The after-coming head and the sacrum are vulnerable during this course of events.

CANT HOOK: a) A tool with a hook for moving things. b) A technique using the principle of such a tool for turning or tilting over sideways.

CIRCUMROTATE: To turn like a wheel. Dr. Sutherland used the term circumduction.

CLIVUS: A downward sloping surface; the sloping surface from the dorsum sellae to the foramen magnum composed of part of the body of the sphenoid and part of the pars basilaris of the occipital bone.

CONCHAE: In anatomy a structure comparable to a shell in shape, as the auricle or pinna of the ear; or a turbinated bone in the nose.

Sphenoidal Conchae – A thin curved plate of bone at either side of the anterior inferior part of the body of the sphenoid, forming part of the roof of the nasal cavity.

CRANIAL BOWL: Dr. Sutherland's term to describe the inside of the cranial base.

DIPLOE: The central layer of spongy bone between the two tables of compact bone which comprise the flat cranial bones.

DIRECT: a) Control or govern the movements of. b) Straight to something. Dr. Sutherland describes a method of *directing* the Tide.

DOVETAIL: a) Something shaped like a dove's tail; a projecting, wedge-shaped part that fits into a corresponding cut-out space to form an interlocking joint. b) Such a joint.

ELECTROLYSIS: Breaking up of tumors or calculi by electric agency.

ENTRAPMENT NEUROPATHY: Classically, a peripheral nerve that is injured by compression in its course through a fibrous or osseofibrous tunnel or at a point where it abruptly changes its course through deep fascia over a fibrous or muscular band.

FIBROSIS: The formation of fibrous tissue as a reparative or reactive process, as opposed to the formation of fibrous tissue that is a normal constituent of an organ or tissue.

FLUCTUATION: The movement of a body of fluid contained within a natural or artificial cavity; observed by palpation or percussion.

FULCRUM: See "*automatic, shifting suspension fulcrum.*"

GANGLION OF IMPAR: The ganglion commonly found in front of the coccyx, where the sympathetic trunks of the two sides unite.

LAMINA TERMINALIS CEREBRI: Terminal plate; velum terminale; a thin plate passing upward from the optic chiasma and forming the anterior wall of the third ventricle, it is the location of the anterior neural tube closure.

LIGAMENTOUS ARTICULAR STRAIN: See *strain*.

MECHANISM: See *primary respiratory mechanism*.

MEMBRANOUS ARTICULAR STRAIN: See *strain*.

MOTILITY: Motile; capable of motion or exhibiting spontaneous motion.

OPISTHION: The midpoint of the lower border of the foramen magnum.

PALATE: a) The bony and muscular partition between the oral cavity and the nasal cavity. b) Bony palate – horizontal plates of the palatine bones and the maxillae; the roof of the mouth.

PALPATE: Handle, as in a medical examination. Palpable; that which can be touched or felt, readily perceived by senses or mind.

PARABLE: Fictitious narrative used as allegory.

PEDUNCLE: In neuroanatomy a term applied to a variety of stalk-like connecting structures in the brain composed either of white matter (cerebellum) or of white and gray matter (cerebrum).

PHYSIOLOGIC CENTERS: A group of nerve cells in the brain stem governing various normal vital processes. See *respiratory center*.

PINTLE: A pin or bolt upon which some other part pivots or turns.

POTENTIAL: Capable of coming into being or action; energy – existing in potential form, not as motion.

PRIMARY RESPIRATORY MECHANISM: The name given by Dr. Sutherland to describe his concept of a physiologic action.

Primary – earliest; of first importance; of first rank in a series; not derived.

Respiratory – breathe; inhale and exhale air; also the exchange of gases across the cell membrane.

Mechanism – structure; system of interrelated parts; system of mutually adapted parts working together as in a machine.

RECIPROCAL TENSION MEMBRANE: The name given by Dr. Sutherland to describe the mechanical function of the specializations of the inner layer of dura mater seen as an interosseous membrane.

Reciprocal – in return; inversely correspondent; expressing mutual action or relation. Reciprocate – *Mech.* to move alternately backward and forward motion with work done.

Tension – a mechanical stress by which a part is moved or pulled when it is part of a system in equilibrium or motion.

Membrane – sheet-like connective tissue.

RESPIRATORY CENTER: The region in the medulla oblongata concerned with integrating afferent information to determine the signals to the respiratory muscles.

SACRAL SAG: A description used by Dr. Sutherland pointing to the drag or pull on the fascial tissues caused by abnormal mechanics in the pelvis; fascial drag.

SCYTHE: Sickle; a mowing and reaping tool with a long, slightly curved blade that is swung over the ground. As the scythe as a whole moves forward the curved end sweeps backward, this being analogous to how the sickles of the *reciprocal tension membrane* operate.

SHELL-SHOCK: Combat fatigue; disabling physical and emotional fatigue occurring in association with military combat.

SPHENOBASILAR JUNCTION: The junction between the sphenoid and the occiput in the clivus is a synchondrosis. That is, initially there is an intervening hyaline cartilage that later in life is converted into cancellous bone. This conversion is generally not completed until 25 to 30 years of age. Dr. Sutherland believed that the cancellous bone that was formed maintained a degree of flexibility throughout life.

STRAIN: An injury or change of structure resulting from difficult exertion or force. Dr. Sutherland emphasized that any strain that involved a joint also involved the associated connective tissue. He referred to strains involving the bony cranium and dural membrane as *membranous articular strains*, and those involving joints surrounded by ligaments as *ligamentous articular strains.*

STRETCH: Make taut, tighten; extensible. The dura mater and ligaments do not stretch.

SUPRAOCCIPUT: The part of the squama of the occiput below the superior nuchal line. The bone here is thin and translucent, and it is protected externally by nuchal muscles.

SYNARTHROSIS: A form of articulation in which the bony elements are united by continuous intervening fibrous tissue. The implication is that these type of joints are immovable.

SYNCHONDROSIS: A type of cartilaginous joint that is usually temporary, the intervening hyaline cartilage ordinarily being converted into bone before adult life.

TRANSLATION: *Mech.* Motion in which every point of the moving object has simultaneously the same velocity and direction of motion.

TRANSMUTATION: To have changed from one form, nature, substance, etc. into another.

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ABOUT THE EDITOR

Anne L. Wales, D.O., began her studies at the American School of Osteopathy before transferring to the Kansas City College of Osteopathy and Surgery. Following her graduation in 1926, she served an internship at the Lakeside Hospital in Kansas City, Missouri and then returned to her native New England. She practiced in Rhode Island for fifty years before retiring to live in North Attleboro, Massachusetts.

In 1943, she and her husband, Chester Handy, D.O., first heard Dr. Sutherland lecture at the meeting of the Eastern States Osteopathic Association in New York City. The following year they attended the course that Dr. Sutherland presented in New York. Based on their experience at that course, they were moved to learn to practice osteopathy as Dr. Sutherland had practiced it and as he taught it. As part of their study, they began attending the meetings of the Lippincott Study Group in Moorestown, New Jersey. From 1945 to 1956, the New England Cranial Study Group met at their office in Providence.

From the time of their first course, Drs. Wales and Handy dedicated their professional lives to the study, practice, and teaching of Dr. Sutherland's work. Over the years they were active in Dr. Sutherland's teaching program and in the work of the Osteopathic Cranial Association. Dr. Handy was one of the incorporators of the Sutherland Cranial Teaching Foundation, Inc.

In recent years, Dr. Wales has continued meeting with study groups in New England and teaching in both formal and informal settings.

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ABOUT THE SUTHERLAND CRANIAL TEACHING FOUNDATION, INC.

The Sutherland Cranial Teaching Foundation, Inc. is a not-for-profit organization which was established in 1953 by Dr. Sutherland and senior members of his teaching faculty. Dr. Sutherland conceived of the foundation as a way of providing a continuity for his teaching.

Dr. Sutherland was the first president of the Sutherland Cranial Teaching Foundation and since his death in 1954 there have been just three subsequent presidents, which has contributed to the continuity in the organization's teaching program. The presidents that followed Dr. Sutherland were Howard Lippincott, D.O., Rollin E. Becker, D.O., and John H. Harakal, D.O., F.A.A.O., who has served as president since 1980.

The charter of the Sutherland Cranial Teaching Foundation calls for the organization to dedicate itself to purely educational activities. It specifically states its objective as using its resources to establish the principles of osteopathy in the cranial field as conceived and developed by William Garner Sutherland, to disseminate a general knowledge of these principles and the therapeutic indication for this approach to treatment, to encourage and assist physicians in osteopathy, and to stimulate continued study and greater proficiency on the part of those practicing osteopathy in the cranial field.

In its endeavor to carry out these objectives the Sutherland Cranial Teaching Foundation supports research, produces publications, and offers both basic and continuing studies courses. As a not-for-profit educational foundation it accepts charitable contribution to support its work of perpetuating and disseminating the teachings in the science of osteopathy as expanded by William Garner Sutherland, D.O. The current address of the SCTF is 4204 Bilglade Rd., Fort Worth, Texas 76109.

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