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Editorial Comments

In 1991, N.U.C.C.A. will celebrate its twenty-fifth year. Founded in 1966, by Dr. Ralph Gregory, the accomplishments and developments have been many, and constitute an on-going process. Re-evaluation of original work, hypothesis testing, clinical observations, and improved method of subluxation analysis, represent the primary focus.

The educational concerns of N.U.C.C..A. have seen tremendous growth. N.U.C.C.A. is now taught at two chiropractic colleges, and its educational conferences are recognized by the Council on Chiropractic Education, and approved for license renewal in most states and provinces.

With the Atlas Subluxation Complex and its health effects on the human body as its foundation, the N.U.C.C.A. board of directors are in the process of planning the next ten years. The validation of the technical system is a priority. Education, research and improved patient care will always remain our goals.

We invite all interested doctors and students to attend the twenty-fifth annual convention.

* * *

The editorial staff is pleased with this issue of the "Upper Cervical Monograph". The lead article by Dr. Dickholtz, Sr. was first presented at the 1990 N.U.C.C.A. Fall Conference, and again at the 7th Annual Upper Cervical Conference. We commend Dr. Dickholtz's efforts to improve the x-ray procedures for the upper cervical practitioner.

Dr. Hasick's article is an introduction to a new lecture presentation that will be given during the 1991 May Conference. Dr. Hasick developed a large N.U.C.C.A. practice in a short time. He credits his success to educating his patients in the value of upper cervical care.

Our focus for this Monograph is the Atlas Subluxation Complex and its effect on the central nervous system. Articles by Gregory, Grostic, Crowe and Kleinman, serve to remind the upper cervical practitioner of the neurological implications of the A.S.C.

Gregory's article, presented as a lecture in 1971, represents N.U.C.C.A.'s hypothesis that direct tractionization of the brain stem due to osseous misalignment of the occipito-atlanto-axial joint complex is the primary cause of the resulting neural dysfunction. Gregory also explores the embryological development and relates C.N.S. function to the clinical practice.

Crowe and Kleinman describe the proprioceptive bombardment hypothesis as applied to the upper cervical spine. This hypothesis, current in North America and Europe, states that proprioceptive bombardment from sensory receptors in the occipito-atlanto joints disrupt normal balance in the reticular formation resulting in disturbed efferent output.

Grostic, Director of Research at Life College of Chiropractic, and co-ordinator of the Upper Cervical Conferences, in his classic article reprinted from the Chiropractic Research Journal, describes direct tractionization of the brain stem by osseous misalignment, while emphasizing the role of the dentate ligaments in such a mechanism.

While the mechanism remains in general contention, research into the function of the brain stem, and the reticular formation in particular, has uncovered its pivotal role in maintenance of homeostasis. As Kandel observed in the *Principles of Neural Science* (1985, p. 560):

> ". . . the principal functions of the reticular formation (behavioral arousal, regulation of muscle reflexes, coordination of autonomic functions, and modulation of pain sensation) are carried out by neurons with widespread sets of connections unlike those found in the major sensory and motor systems. Even though many of its neurons are not grouped into distinct nuclei, the reticular formation is organized quite precisely to accomplish its functional role."

Those with clinical experience in the correction and care of the Atlas Subluxation Complex will recognize the association of the above defined functions.

The final piece (by Nigron) represents a summation of data collection with correlation. We would like to publish the computerized data base itself in the near future. The upper cervical practice offers more objective information for data collection than any other, and must continue its efforts to validate the technical systems used to correct the A.S.C.

The editor wishes to thank all the authors for their fine contributions in this issue.

K. E. Denton, D.C.

Errors in Taking of Cervical X-rays and Their Effects on Analysis

By Marshall Dickholtz, Sr., D.C.

A stressor to the central nervous system is produced when there is a misalignment of the atlas, as little as three-quarters of a degree. Great accuracy is needed in taking cervical x-rays in order to determine the force vector and torque for a proper adjustment. A precursor to determining the force vector and torque is to eliminate errors in the taking of the cervical x-ray.

A major error occurs with not having one's x-ray equipment aligned. If the x-ray is aligned, the distortion effect from unequal magnification is eliminated. Any symmetrical object that is not divided by the central ray, and any part of that object that is at a different distance from the film, will have the same effect.

It is necessary that a centering head clamp with alignment rod be used when taking cervical x-rays. All cervical x-rays are taken at a 42" focal spot to film distance. A string attached laterally to the focal spot is necessary for aiming the central x-ray.

The Lateral View

The first film to be taken for the determination of the S-line (nasal projection) can also be misinterpreted if not set up properly.

Never change the tilt in the patient's head. The change will disrupt the position of the atlas in relationship to the rest of the cervical vertebrae and the head. To get the proper S-line, the patient's head should be aligned so the inferior portion of the ocular orbit is horizontal with the auditory meatus. (The patient should not be looking up or down). The grid holder or bucky and x-ray tube should be parallel to the head with the central ray projection going through the head at the level of the ear lobes, with no twist of the head. Turn the chair, if necessary, to align the patient's head. This film should give the proper S-line for a nasal view. If the x-ray beam is not at right angles to the patient's head, you will see both sides of the posterior arch, most of the time, and get an improper interpretation that will result in the wrong projection of the posterior arch on the nasal film. (See Figures 1, 2, 3.)

There can be an exception to this. The posterior arch can move up or down when the patient's head is dropped slightly for a nasal film (when there is an S-line of one or more). Therefore, after viewing the nasal film and the posterior arch is too low or too high, take it over, but adjust for a proper posterior arch projection.

The Nasal View

A perfect nasal film will show: (film size should not be smaller than a 24 x 30 cm.)

1. No rotation
2. Parietal region that is not overexposed
3. A slightly elevated posterior arch, with proper viewing density (detail) at the attachments to the lateral masses
4. Axis spinous and odontoid
5. Lower cervicals and first dorsal with spinouses

There should not be any rotation in this view. In general, if there is rotation and it is analyzed, laterality will appear to be increased when the head is turned to that side, or, decreased if the head is turned away from the side of laterality. This is not a 100% rule. Take another nasal film, especially when it appears to be a small laterality. (See Figure 4)

Also, in head rotation, the nasal shadow could cover the posterior arch attachments. There are also some ligamentous structures that could do the same thing.

Attachments of the posterior arch to the lateral masses has to be pinpointed. An error in miscalculating the S-line from the lateral film will show a posterior arch that is too high or too low. A low arch would cover the inferior attachments and too high an arch would probably result in an erroneous listing.

It is recommended that after taking the first nasal view, raise the tube head two inches and set the angle for another film. Use the best one, but also look at the other for confirmation of details.

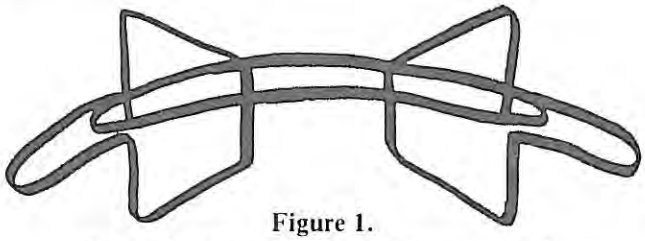


Figure 1.

Example of posterior arch being too high.

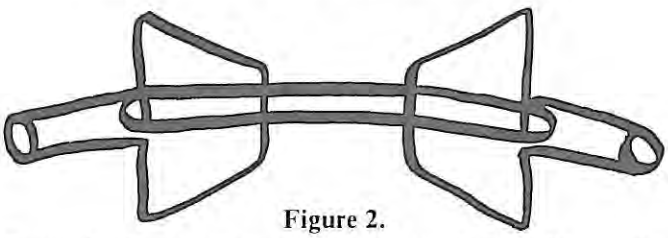


Figure 2.

Example of posterior arch in proper position with posterior root attachments.

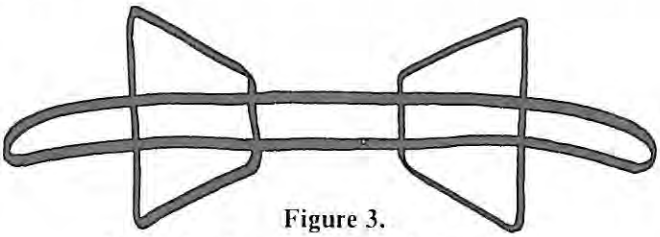


Figure 3.

Example of posterior arch being too low.

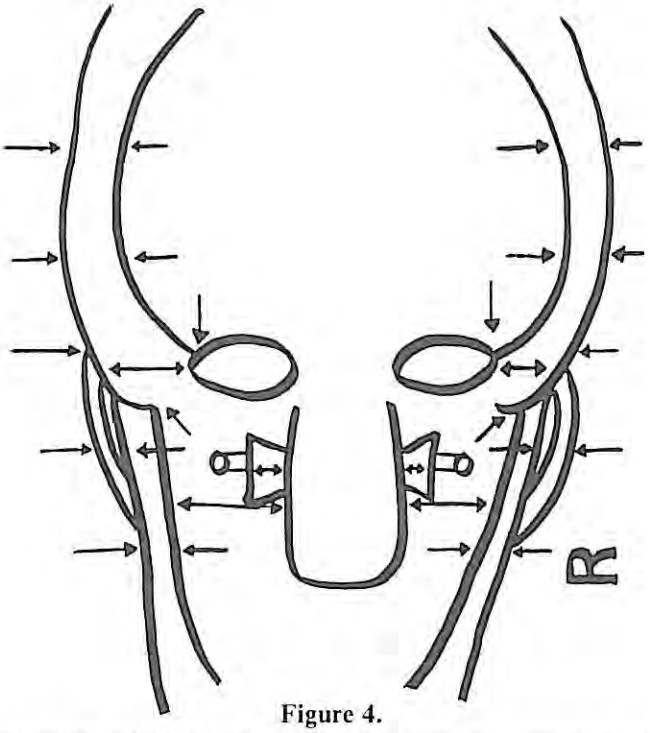


Figure 4.
Example of right head rotation. Compare corresponding arrows on opposite sides.

When teeth are in the way of pinpointing the posterior arch attachments, a slightly higher arch may be necessary.

On taking high S-line exposures without any x-ray filtration, the parietal region would be overexposed if the lower cervicals and spinouses were to show on the film. The opposite may also be true. By using thin lead filters (.0006 to .010 of an inch) one can reduce radiation to the top two-thirds of the film.

Never raise the patient's head for a nasal film. This could also produce an error.

Axis spinouses can also be misread if there is rotation in the nasal film. If the axis spinous is difficult to locate, follow the lower cervical spinouses up. The lateral view will show the proximity of the bifurcation of the axis spinous to the posterior arch and the third cervical spinous. Sometimes the odontoid is hard to locate. Look at the inter-odontoid spaces of the vertex film and then locate it on the nasal film. The medial surfaces of the lateral masses on the nasal film are generally very visible, and after the inter-odontoid spaces are found the odontoid can be identified.

The Vertex View

In order to have a perfect vertex view, begin with a chin-centering device, a plastic mirror with a vertical center line (placed on center near the top of a 10x12 grid carrier), and a thin white lead base paint vertical center line on your grid holder or bucky. This line will appear on all the films. The NUCCA chin-centering unit should be set so the bottom of the chin will project one inch above the center of an 8x10 film. When a vertex film is taken, the glabella and the nasal septum will be superimposed on the center line. The projection of the lower cervicals will also be divided by the same vertical line. To achieve this, the chair should be moved so the patient's base of support, the pelvis, is in line with the grid holder. If there is a twist of the head on the projection, there will be an error in measuring rotation. The axial canal can also be misinterpreted. With perfect films, the axial canal on the vertex and the bifurcation of the axis spinous on the nasal film should agree. Otherwise, use the vertex film for axis rotation. The skull projection should not extend to the bottom of the film or the projection will be too short. If the projection is too short some accuracy will be lost and the atlas foramen transversarium will be hard to discern. If the projection is too long, the image will lose detail.

Other foramen at the bottom of the skull can also interfere with the proper interpretation of the atlas rotation, especially if the central x-ray beam is not aimed at the atlas transverse - 90° to a line drawn from the tip of the mastoid to the superior aspect of the ocular orbit.

The string should be used to double-check the projection of the posterior portion of the skull to the film. If it does not look like this projection is correct, double-check the 90° setting.

By using a compass with a 3″ spread and bisecting the atlas from the center of its foramen, the line should go through the anterior and posterior tubercles of their respective arches. A line that bisects the foramen should be parallel to a line that divides the lateral masses. This is the only way to accurately check the foraminae for true atlas rotation.

A plastic templet (with vertical and horizontal lines) called a "vertex square" also should be used to overlay the atlas on the vertex film in order to show the relationships of all its parts to the whole vertebra.

A lower KVP should be used when taking x-rays of children, elderly or osteoporotic patients. The reducing of the KVP can also be used to bring out more detail on certain cases when it is needed. By lowering KVP, exposure time should be increased.

Conclusion

It is essential that errors in the taking of x-ray films be eliminated if the accurate analysis of the x-ray films is to be realized. Common types of errors were discussed in the article.

For further information about taking precision x-rays see:

Monograph Vol. 2, No. 8, Jan. 1980: Patient Alignment for Upper Cervical X-rays

Monograph Vol. 4, No. 8, June 1989: Comments and Concerns as: X-ray Radiation (A Guide for Upper Cervical X-rays)

N.U.C.C.A. X-ray Alignment Booklet for proper installation of equipment

The above articles and booklet are by this author.

Dr. Marshall Dickholtz, Sr.
Chicago, Illinois

An Introduction to Patient Education

by D. Gordon Hasick, D.C.

Patient education and communication is a wonderful challenge and is essential for excellent care. The word "education" comes from a Latin word meaning to "draw out of". The word doctor refers to a teacher. One of the responsibilities of a doctor is to teach, educate, or in other words, draw out of the patient their inherent abilities to be well.

We are not born with the information to properly care for ourselves and exemplify a well balanced lifestyle. We must learn how to live a balanced life in all areas. How does one obtain this information other than from the experiences of distinction; finding out what does not work, and seeking to find what does. Patients consult our offices for various reasons, but mostly for assistance and education.

The role of the doctor is not to tell patients what to do all the time but most importantly, to remind the patients of their responsibilities in caring for themselves. Then the doctor should provide the tools or information to accomplish this task. It is important that the patient and the doctor clearly understand their respective roles and their responsibilities.

The doctor teaches, and in a National Upper Cervical Chiropractic Association (NUCCA) practice, corrects the subluxation. The patient's role in his care is equally important for the success of the treatment. No longer can a doctor be perceived as a mechanic to fix the body when the patient chronically abuses his health. Healing comes from the patient and not from the doctor.

The nature of this article is to provide some information relative to patient management in a NUCCA practice. The primary purpose of the NUCCA practice is to correct the Atlas Subluxation Complex Syndrome (ASC Syndrome), and monitor the changes as the patient improves in bio-mechanical and neurological symmetry and balance.

The correction of the subluxation is the essence of the chiropractic practice. The patients contacting your office are doing so for various reasons and to obtain information and care on how to improve their current state of health and wellness. Patients cannot be managed and told what to do; however they can be educated, encouraged and supported in their pursuit of health and wellness.

The objective of a doctor is to provide technical excellence in spinal care along with education, encouragement and support as the patient moves from a state of illness to wellness. This includes referring the patient to another health care provider for services and care that may help solve the complex puzzles of health and wellness.

Pain is a common part of our life experience. Understanding what is causing the pain is an essential challenge for the NUCCA doctor of chiropractic. The cause of the patient's condition may be linked with the ASC Syndrome. Health and wellness is not the result of only one factor but the accumulation of many factors involved in the patient's life experience. Life-style in combination with the subluxation complex will combine and cause distress on the body. The result is the patient's present state of health and wellness. The lifestyle and history of experiences of the patient help in the creation and the correction of their condition.

The doctor should take a proper case history on the first visit. The necessity of a proper case history is to more fully understand the nature of the patient and the condition he presents. From a medical perspective it is important to understand the nature of the signs and symptoms, the date in which the condition was established, long term effects, the exacerbations and remissions of the symptoms, the location, the nature of the pain, and pertinent information relative to whether or not the condition presented by the patient is that of a life-threatening condition.

The proper taking of a history is a most challenging opportunity. To relate, from a chiropractic perspective, the importance of the history relative to the patient symptoms and past trauma, the doctor must know the extent of the injury and how and when the subluxation complex was produced. The length of time since the onset is an important factor in the recovery time.

Often patients do not consider the seemingly minor incidents and accidents throughout their lifetime important enough to produce any injury. There may not have been an apparent injury to the patient at the time of the accident. Consequently, the majority of the injuries incurred at that time may not become symptomatic for up to two or three years following the injury and at times, seven to ten years following an initial trauma.

The NUCCA organization has set out to establish and research the vertebral subluxation complex and its specific correction. Through its years of research, NUCCA has established a system in which the patient may be assessed and treated most effectively for a condition that has very far reaching neurological effects. This condition is the ASC Syndrome. The ASC Syndrome is seen in patients with a subluxated C1 vertebrae, leading to an over innervation of the motor neurons of the spinal cord and is well researched and documented by NUCCA. This leads to a neuro-muscular imbalance with postural asymmetry leading to leg length disparity. This bio-mechanical asymmetry is a major stressor to the human body and is a positive factor in creating a variety of conditions, signs and symptoms.

It is a primary goal of a NUCCA practitioner to examine, assess and correct the ASC Syndrome. It is then important to monitor the changes the body will go through in the ensuing months as restoration of the human frame to a normal bio-mechanical symmetry and position is re-established.

The long term health maintenance of a patient's spine

is a priority. It is important to educate the patient on the importance of how seemingly minor trauma, and the implications they may have in the production of the subluxation complex, ultimately affect the neurological balance of the human body. A very small percentage of the nerves in the human body are responsible for carrying pain messages, therefore, a subluxation complex can exist creating neurological distress and no pain or symptoms may be experienced at that time. It is not until further structural and neurological changes occur that the patient experiences symptoms relative to the initial trauma. Educating the patients on this and further preventative steps is a primary responsibility of the doctor.

Once the history is taken and a correlation with the history of trauma (which can relate back to birth) has been established, the patient may have a clearer understanding as to the types of trauma that will injure and re-injure the spine. The patient should be educated regarding the intricacy of the human spinal column and its relationship to the nervous system and all other systems of the body. If patients do not recall episodes of trauma or injury, they may check with relatives, parents, etc., if they should desire to fully understand the nature of their injury.

The causative factor relating to the symptoms may be a moot point, as the original traumatic injury cannot be changed. It is only out of interest that the patient may wish to know and, if possible, the correlation should be made. However, the state of the spine must be assessed as it presently exists and is presented to the office. The spinal examination on the initial visit should include assessment of postural symmetry, pelvic distortion and leg length disparity. These are the physical manifestations of the ASC Syndrome. If it is concluded that the patient presents with the findings of an ASC Syndrome then the pre x-ray examination is performed to determine the specific nature of the subluxation complex. Once the pre x-ray examination is completed and the patient's subluxation complex is properly assessed, the patient can then be adjusted.

Prior to the initial correction, the patient's review of findings should be aimed at having him understand, in simple terms, the mechanics of the subluxation and how it produces the tractionization of the nerves. This should be demonstrated by showing the patient his pre x-rays and using a spinal model to reproduce all the structures requiring correction. A correlation should be made relating the subluxation to the vertical axis and the correction that needs to take place. The relationship of the subluxation to the physical findings, including leg length disparity, pelvic distortion and postural asymmetry is then correlated. This establishes a purpose for the adjustment in the patient's mind.

Management of the different types is exceedingly important in that a normal pattern Type 1, 2, or 3 may respond and stabilize in a relatively short period of time whereas a Type 4, an abnormal pattern, may require additional time to establish stability and balance as it returns to the vertical axis.

The initial adjustment is provided. Following the initial adjustment, the post x-ray assessment will provide information relative to the extent of the correction. This is valuable in that the progress of the patient and the response to the treatment is directly related to the correction provided in the subluxation complex. In general terms, the better the correction, the better the response.

The complexities of the nervous system provide a variety of responses to an adjustment and every patient responds in a different manner. It has been shown through study, post-surgically, that patients respond to a treatment in a cyclic fashion in a twenty-eight day period, thus the establishment of the 28 day healing cycle (see Figure 1). The patients, following initial treatment, respond and may experience more changes symptomatically on the third, seventh, fourteenth, twenty-first and twenty-eighth days.

It is important that patients understand that symptoms indicate a change is going on, and provided the post x-rays assessment reveals an accurate and proper bio-mechanical correction, the symptoms that the patient would experience would be of a positive nature as the body recovers and heals. As with all conditions and problems in the human body, there is a time factor involved in the healing process. Healing is not an immediate response and the adjustment is not designed to alleviate the symptoms immediately.

The adjustment is designed to restore the spine to its normal bio-mechanical balance and bring all the structures back to the vertical axis. Since that is the primary goal and purpose of the adjustment, the patient's symptomatic response should be monitored but not considered singularly in the decision to adjust or not adjust the patient.

As patients respond in the initial twenty-eight day period, a variety of signs and symptoms may present themselves. However, the objective findings, such as leg check and Anatometer or pelvic measurements, provide an objective assessment of the patient's response. Many times patients will respond and present with a variety of symptoms;

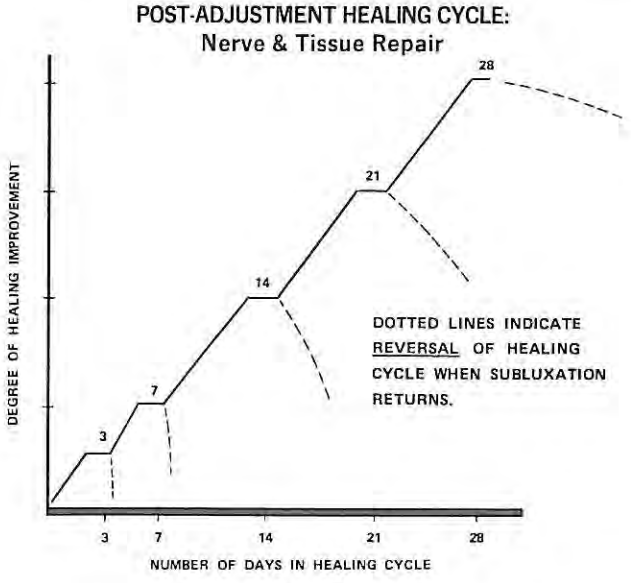


Figure 1

however, no adjustment may be necessary. This may continue for three to four weeks before the patient responds in a symptomatic way that is seen and felt as positive. This provides the NUCCA practitioner an easy task; to monitor the progress of his patients by staying with the objective findings and not placing a great emphasis on the subjective findings, such as symptomatic changes. Symptoms are not ignored but not emphasized in the care.

Some of the factors that determine the response to the adjustment are the length of time a patient's condition has existed, the age of the patient, the severity of the subluxation complex and the extent of nerve damage. It is through extensive clinical experience in handling a variety of cases that the doctor will be better able to provide a more accurate prognosis for the patient's condition.

The effects of the adjustment on the nervous system are rather profound and include an effect on the sensory as well as the motor control of the nervous system. This is exhibited by change in the postural muscle of the spinal column and the change in the leg length disparity.

There is often a change in the sensory activity of the nervous system following an adjustment and this is demonstrated by an increased activity of the sensory system. This can be seen by an increase in symptoms and signs in various parts of the body. Old injuries may become symptomatic again and present symptoms may become more accentuated.

Once again to properly assess and evaluate the patient's progress and manage the case properly, it is important to rely on the objective findings such as post x-ray, leg check, postural distortion and thermographic findings. This enables the doctor to assess whether the patient does or does not require an adjustment. It is just as important to know when not to make the adjustment as to know when to make the adjustment!

D. D. Palmer and other technique developers established the same protocol in case management. The subluxation is to be determined and once determined and found, corrected and left alone. It is leaving the subluxation and the body alone and not interfering with the healing process that provides the best long-term effects. It is not uncommon for patients under NUCCA care to experience tremendous changes in the first twenty-eight days and maintain or hold their first correction for a period of months.

The symptomatic results depend on the correction to normal of the misalignments and detractionization of the nerves. Stability is required for a time period long enough for nerves to be restored to normal diameter, necessary to their conduction of normal impulses.

Maintaining or holding a correction means that the normal balance is maintained in a state of equilibrium. This enables the healing process to take place and allows for correction of the nerve imbalance. It is important to always maintain a state of balance to ensure optimal function and expression. It can not be considered a failure if it takes some time for a patient to hold an adjustment for extended periods of time.

As we further research the subluxation complex, we will (perhaps) understand what we can do to provide more long term benefits for all our patients. The tendency is that once an ASC Syndrome has been corrected and has been left alone to recover on its own, the long term effects provided for the patient have proven to be most beneficial. There are inherent recuperative abilities in the human body controlled through the nervous system that must be respected and worked with.

There is current research in a relatively new area of human physiology known as psycho-neuro immunology. This is the area that studies the link between the brain, the thought process, the nervous system and the immune system and the effects that these have on our body's ability to resist, to fight and to heal ourselves. These studies have shown the link between these systems is much more complex and intricate than once believed. This research is now confirming many of the thoughts and beliefs that chiropractic has spoken of for many years. The human nervous system requires a great deal of respect, not only in its treatment but in its preventative steps.

The primary challenge of the NUCCA chiropractor is the assessment, correction and management of the ASC Syndrome. It is a system of health care that deals in an exceedingly scientific and specific manner with health and wellness and is able to provide management from an extremely objective point of view. The case management of all patients can become very straightforward and will provide many patients relief from conditions for which they previously have been unable to obtain help.

Following the healing cycle, after the initial adjustment, the patient should be examined on the third, seventh, fourteenth, twenty-first, and twenty-eighth days to ensure that the patient is maintaining or holding his spinal correction. During that time the patient may experience a variety of symptoms, however, the objective tests will provide the information as to whether an adjustment is necessary or not.

Following the initial twenty-eight day period, the patient's spinal condition will continue to change and remodel over a number of months. The number of months depends on the extent of injury, the type of bio-mechanical problem the patient presented, and the patient's participation and adherence to the recommendations. It is a recommended procedure, in my clinic, to assess these patients on a six to eight week interval for ten to twelve months, following the initial twenty-eight day period.

Our quality of health and wellness can be improved dramatically by taking some very simple steps in the preventative and restorative care of the human body. It should be the desire of all doctors to provide direction for the patient's well being. NUCCA is a health care system which consistently provides quality health care through the correction of the ASC Syndrome and also follow-up care ensuring an optimal state of wellness. As a NUCCA doctor you can provide the care and the direction to assist and support the patient in his pursuit of wellness. "Salus Aergroti Suprema Lex"—"The welfare of the sick is the supreme law".

Structure and Function: Embryologic Development and the A.S.C.

(first presented to 1971 NUCCA Convention)
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No single system of practice in chiropractic has met with more resistance than specific upper cervical. At times, as you know, this resistance has been colored with emotional overtones. Chiropractic institutions have tended to discourage upper cervical practice and, on occasion, disciplinary bodies have treated upper cervical practitioners in a manner that bordered on discrimination.

In the past year two instances of such treatment have been brought to NUCCA's attention. Charges have been lodged against upper cervical practitioners that might have resulted in loss of license for a period of time. NUCCA, in conjunction with defense attorneys, worked out an adequate defense against these charges which were so ridiculous that they indicated pure maliciousness on the part of the disciplinary boards. It would seem in the light of these developments that we need a strong national organization.

I suppose it is the tendency of a profession to resist changes when those changes call for a re-evaluation of established practices. Further, I suspect that ignorance of a different system of practice enters into the problem. In the case of jural law, ignorance is no excuse for violation of the law; in the case of natural law — the laws of physics, physiology, kinesiology — ignorance does not lessen the penalty which such violation imposes. In the former case, it is the defendant who pays; in the latter instance, it is the patient.

In view of many of the changes which are resulting from our study of the A.S.C. and its widespread influence over the lower spine and the neuro-muscular mechanisms of the body, it is expected that further tension will develop. This is unfortunate; it is to be regretted, but it can not be permitted to deter us. What we are doing is perfectly legitimate and should be done. It is in the natural course of the development of a profession. Resistance no doubt will increase and it will take many forms. As I mentioned before, one of these forms may be some sort of ethical or disciplinary action against you. Other forms may be in simple denials of some aspect of your work. For example, faculty members who deny the value of measurement of the misalignment factors, or the effect of the misalignment factors themselves. Both of these denials have been issued from the NUCCA platform in past conventions. There are always clever ways in which to create doubt and foster confusion. These methods will not work with the thinking individual, and you are well aware that measurement of the subluxation's physical factors and reduction of these factors are vitally essential elements in the progress of any patient. The upper cervical practitioner has done more to prove the efficacy of the basic chiropractic premise than has any other group in the profession. Our crime is that we have sufficient faith to promote a testing of our hypotheses and the courage to reject that which is a priori.

Because of the situation which I have briefly alluded to, I would like to point out a few simple neurological facts that may not have occurred to you, and certainly have not occurred to your detractors. These will be, I think, of value to you in defending your practices. First, we will very briefly look at some simple facts about the development of the nervous system from an evolutionary basis, then from a developmental standpoint; and, further, from the relationship of the A.S.C. to the central nervous system.

If we examine the evolution of neurological development, the protoplasmic design and the alteration of design as a result of the lowered threshold to those environmental changes to which an organism must adjust to survive, we observe structural differentiations in the protoplasmic design of the primary organism. These structural differentiations seemingly come about in response to an increase in the sensitivity of the primary organism to the stimuli of its environment. In this response to stimuli perception, which brings about changes in the structure of the primary organism, we find the beginnings of the primitive nervous system. Eventually conduction pathways appear, little thread-like condensations, within the protoplasm, which serve to conduct stimuli, making the organism more responsive to its environment, making information regarding the environment more accessible to the organism, insuring its survival. In this way does the primitive neural system develop.

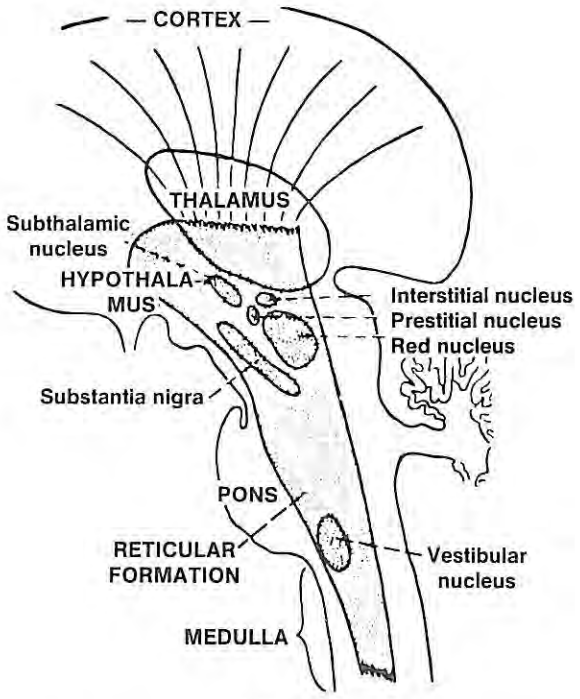


Figure 1.
The Reticular Formation and associated nuclei

When these thread-like condensations of protoplasm are severed, the entire organism is disrupted; it is no longer sufficiently organized to make an adequate response to its environment.

Thus is the nervous system begun. Seemingly, from the standpoint of structure, it is sensory before motor. First the call, then the answer; the stimulis, then the response. Not from within out, but from outside in.

As the nervous system developed over eons of time, it became important to the survival of the organism that a more complex system evolve. Development of the organization required further development of the neural system. Integration and discrimination of stimuli became a factor as bombardment by the organism of various stimuli required selection of stimuli. As the organism developed into a more complex living system, so also did its neural mechanism until we reach the state of the vertebrate with its highly complex nervous system, its spinal cord, reflex controls, but all subject to the still developing brain.

The study of the evolutionary development of the nervous system from the primitive single-celled organism to man, supports the contention that adjustment of the spinal column fails to liberate the imprisoned nervous impulses unless and until the A.S.C. is corrected by specific adjustment. There can be no adequate response of the higher nervous centers to stimuli, either from the internal or external environment, until the pathways through which these stimuli travel are opened. Beyond a few simple reflex controls, these stimuli must receive discrimination and integration by and from nervous structure above the foramen magnum, the medulla, the basal ganglia, and the cortex.

The subluxation at the Occipital-Atlanto-Axial area is detrimental to the conveyance of information over both sensory and motor nerves. You have heard it said that subluxations do not affect sensory nerves. If they do not, you and I had better cease what we are doing. How can a motor system respond to stimuli which it never adequately receives? The whole process of the evolutionary development of the neural system indicates the importance of the sensory system. A subluxation on sensory fibers modifies motor impulses.

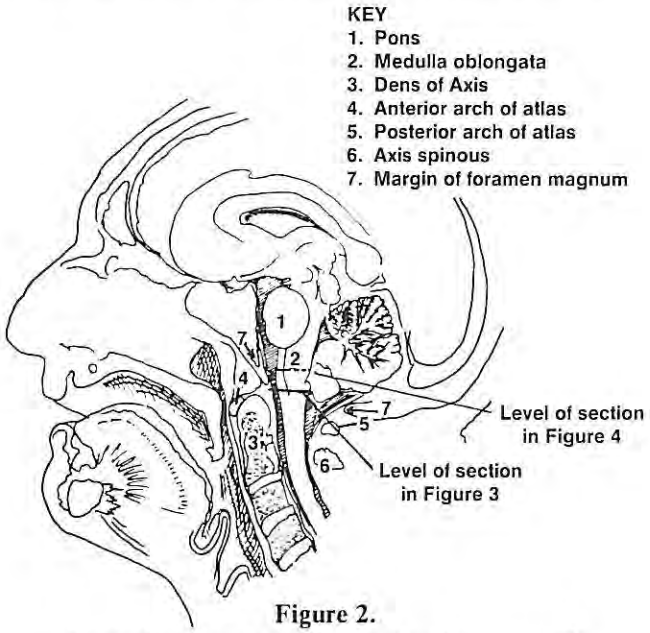


Figure 2.

Sagittal section through head and upper neck

From the developmental standpoint, the embryological standpoint, the medullary plate of the embryo fuses in a manner that converts the open medullary plate into the neural tube. I am sure that you recall this from your studies in Embryology. The neural tube, as a result of different rates of cell division, bulges out into three balloon-like structures at its cephalic one third. These are technically called the evaginations. These evaginations are functional divisions and are important to an understanding of the nervous system.

From the head end of the tube, the first bulge is known as the telencephalon or primitive forebrain. The second evagination is called the mesencephalon, the mid-brain. The third is the myelencephalon, or hind brain. All of these, please note, are outgrowths of one basic structure, the neural tube, which is the beginning of the nervous system in prenatal life. It includes within it the potential for the brain and the spinal cord and nerves.

In the forebrain there occurs an increased rate of acceleration in cell division. This gives rise to the structure that will eventually become the cerebral hemispheres. In the caudal end or two-thirds of the neural tube, the rate of cell multiplication is much slower, less development takes place. The caudal two-thirds will become the spinal cord.

Thus, embryologically, we can see that from the standpoint of structure the spinal cord is of lesser importance to the organism than are those nervous structures that are more cephalic to it. We can further see that, consistent with those mysterious directive forces that are developing this system in the embryo, greater speed and greater complexity are required. Structure precedes and determines function.

Therefore, pre-natally we observe that the nervous system develops from a single structure—the neural tube. It develops in such a manner that structure is rapidly built at the cephalic one-third of the neural tube so that function will be enhanced; not so in the caudal two-thirds of the neural tube. The rate of cell multiplication is much slower and much less. It is of lesser importance to the future of the organism.

As the spinal column develops from the notochora, the position of the Atlas Subluxation Complex will parallel the position of that area of the neural tube that corresponds with an imaginary line dividing the cephalic one-third of the neural tube from the caudal two-thirds.

We might again ask the question: Why is correction of the A.S.C. so important? We have shown some evolutionary aspects and some developmental indications. Let's look at the question from the standpoint of the developed human organism.

Often we have spoken of the effect of the A.S.C. on bodily distortion, the contractured leg, produced by spastic contracture of pelvic and lumbar musculature, the result of the suppression of the inhibitory influences by the A.S.C.

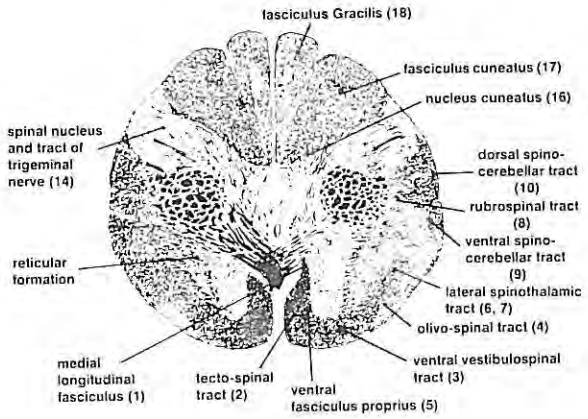


Figure 3.

Transverse section of Medulla oblongata just cephalic to the Foramen Magnum (at level of pyramidal decussation)

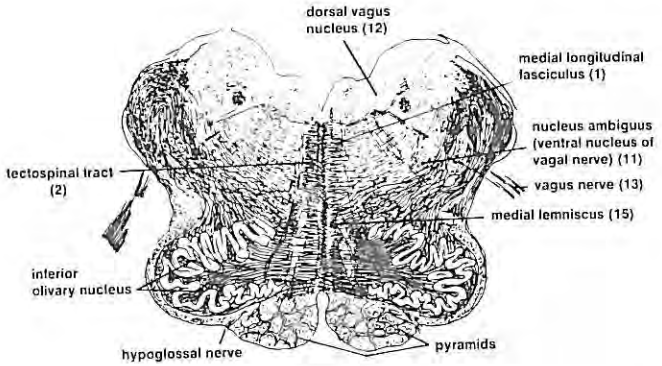


Figure 4.

Transverse section of Medulla oblongata near middle of inferior olive

on nervous structure just above the foramen magnum.

We might point to the medulla oblongata, the vital node, without which no vertebrate can exist for any length of time. Why? Because the neural circuits lodged in the medulla are primarily concerned with the regulation and control of body chemistry. We ingest food which must be converted into chemical compounds. We inhale oxygen which is essential to the making of chemical compounds. As these compounds are manufactured, they must be distributed to all parts of the body. The delivery system is, of course, the blood driven by the heart.

These three visceral mechanisms, as they are called, are regulated and controlled from the medulla; ingestion of food, conversion into chemical compounds and distribution to the cells of the body, all controlled and regulated from the medulla. Involved in this are the digestive tract, the respiratory system and the blood vascular system.

The location of the medulla oblongata is from the inferior border of the foramen magnum to the inferior border of the Pons. But these three visceral mechanisms are not automatic or self-controlled because they are influenced by neural impulses from higher up in the central nervous system. The basal ganglia and the cortex give off connections to the medulla. How can these be influenced by adjustments of the spinal column below the occipital-atlanto-axial area?

If we look within the medulla, we find the reticular system. Within the reticular system, is found the control of the peristaltic action of the digestive tract. At its cephalic end is found the vomiting center, the centers for hunger, the control of the swallowing mechanism. And, if time permitted, we could mention more. As we said, the medulla regulates and controls the three visceral mechanisms vital to life. We ask the question: How do spinal adjustments below the atlanto-axial area influence these mechanisms?

A misaligned thoracic, lower cervical, or lumbar vertebra has never been demonstrated to detrimentally disturb structure in the medulla or above it. The A.S.C. has clinically been shown to do so by measurement. If structure determines function, and it does, any subluxation must disturb structure because a subluxation is a mechanical entity. Altered structure produces changes in function; therefore the misalignment factors are the only physical means by which structure can be altered within the subluxation concept.

It is a well known neurological fact that there exists an heirarchical organization of the central nervous system. Higher levels influence the lower areas from the cortex to the final common pathway. Even the autonomic nervous system is not a completely autonomous unit. It is not capable of taking care of the viscera without modulation from the central nervous system. Even a simple local reflex of the spine is subject to modification by the central nervous system. How do the lumbar, thoracic and lower cervical vertebral adjustments influence these controls?

In what manner does the A.S.C. alter neurological structures above the foramen magnum? Mainly by tractionization of the fibers. Any misalignment factor of the A.S.C. is capable of producing tractionization above and below the foramen magnum. Tractionization can take place in the frontal plane, the sagittal plane and the transverse plane. Tractionization of nerve fibers is well known to change conductivity of nerve fibers; to damage nerve fibers. Cervical kinks most certainly produce tractionization of nerve tracts both below and above the foramen magnum. Thus two kinds of tractionization occur in the majority of A.S.C. subluxations. They are lateral and longitudinal tractionization. Included are the tractionization of spinal nerve roots. Enfoldment of nervous tissue occurs on the concave side of the cervical kink. What do you think happens to the synaptic junctions under tractionization? Separation of the neuronal junction may well destroy or reduce the chemical basis for the conduction of the nervous impulse at these points.

A cross section of the medulla just above the foramen magnum gives us a rough idea of the location of some of the more important tracts. Here we see the pyramids located so that they would be subject to tractionization more readily in certain types of subluxations of the A.S.C. Imagine, if you will, the influence of an inferior atlas on

these tracts. These are the tracts that transmit the voluntary signals to the body. How frequently do you find an inferior atlas in a patient who has interference with voluntary movement?

1. The medial longitudinal fasciculus (M.L.F.): thought to have much to do with coordination of eye control and with association fibers connecting nuclei of the hind-brain and mid-brain.

2. The tecto-spinal tract: originates in the superior and inferior colliculi of the mid-brain and which send their axis cylinders through the tegmentum, cross the midline to the opposite side, then down the brain stem into the spinal cord to end about the final common pathway. This is the neural basis for the startle reflex to light; also the startle reflex to noise.

3. Ventral vestibulo-spinal tract: arises in the lateral nucleus of the vestibular nerve and is concerned with equilibratory reflexes.

4. Olivo-spinal tract: arises near the olivary nucleus in the medulla. It goes to the cervical area only and its function is not known.

5. Ventral fasciculus proprius: multisegmental fibers from one segment of cord to another.

6. and 7. Lateral spinothalamic and spinotectal tract: both arise from cells in dorsal column and cross over, ascending to higher nervous centers. The function of the lateral spinothalamic is to transmit pain and temperature, and of the spinotectal, modification of the spino-visceral reflex.

8. Rubro-spinal tract (pyramidal and extra-pyramidal): origin in red nuclei. And in F.C.P. function's cerebellar reflexes, motor coordination in walking, and also equilibrium.

9. Ventral spino-cerebellar tract: neurones in the spinal ganglia whose peripheral endings are in the deep tissues of the body: the proprioceptive neurons, also send their axis cylinders into the C.N.S. Some of them end in the posterior horns to meet with the dendrites of new neurons whose axis cylinders run up the lateral column to enter the cerebellum as the spinal-cerebellar tract.

10. Dorsal spinocerebellar tract: arises much the same as the ventral spinocerebellar tract and along with this tract carries information about the status of muscles, tendons and joints.

11. Ventral nucleus of vagus nerve: somatic motor fibers arise from this nucleus. This is the so-called nucleus ambiguus which has a special visceromotor function concerned with striated muscle.

12. Dorsal vagus nuclei: it is of interest to note that chiropractic has not concerned itself with interference by the subluxation to sensory nerve fibers, placing mostly emphasis on the motor outflows. This, in my judgment, has been a mistake. In reality, sensory interference may be of equal importance with motor. I think the vagus sensory system illustrates this quite clearly. The beginning of all neural activity in the primary systems is dependent upon increased sensitivity.

13. The vagus nerve figures prominently in the control of motility and secretion of the stomach, control of the respiratory rhythm, innervation of the digestive system, and innervation of the heart. Through the sensory portion of the vagus nerve, the medulla oblongata is notified of the state of the chemical factories of the body, to which information the reticular system in the medulla adjusts body chemistry, peristalsis, respiration, heart-beat and the state of the vascular beds. The vagus nerve has much to do with maintaining the homeostasis of the body. The vocal cords also are activated through the vagus nerve.

14. Spinal nucleus and tract of trigeminal nerve: this is the great sensory nerve of the head and face; the motor nerve to the muscles of mastication.

15. Internal arcuate fibers of the medial lemniscus: these fibers are part of the sensory decussation to the thalamus and then to the cortex. They function to convey impulses of muscle sense and tactile discrimination.

16. Nucleus cuneatus: from which the fibers rise to the internal arcuate.

17. Fasciculus cuneatus (Tract of Burdach): whose origin is in the posterior roots of thoracic and cervical region, ascend to the medulla oblongata to end in the gracile and cuneate nuclei. They conduct impulses of conscious muscle sense.

18. Fasciculus gracilis (Tract of Goll): whose origin is in the posterior nerve roots of the sacral, lumbar and lower thoracic rising to end in the nucleus gracilis of the medulla. Both of these tracts connect with the cortex via the thalamus.

It seems quite evident if we relate these tracts to the misalignment factors of the Atlas Subluxation Complex that movements of the A.S.C. into the transverse plane may well interfere with sensory perception to and through the medulla oblongata and even into the mid-brain. This may explain why maladjustments that create severe rotations of cervical spinouses seem to make the patient feel better for a time. I think it is also apparent that rotations of the atlas and axis into the frontal planes of the body disturb motor function into the final common pathway over the pyramidal system (voluntary) and the extra-pyramidal system (involuntary). The location of the rubrospinal tract flanked by the spinocerebellar tracts interestingly suggests the reason why a patient may feel so badly just prior to the inception of the A.S.C., then, as the A.S.C. becomes active, may feel better for a period of 3 to 4 days, then become symptomatic again.

In this brief and over-simplified structural-functional presentation, I have not attempted to give more than just a brief idea of the topographical relationships that could be more detailed and accurately presented. If I have made you more conscious of the importance of keeping yourselves checked and in adjustment I have served one purpose. If I have impressed on you some scanty information which you may develop to answer your detractors, I have served another purpose. To this, I might add that if I have warned you against the dangers of non-specific adjustments of the atlas, or manipulation of the atlas, I have served a greater purpose.

Upper Cervical Influence On The Reticular System

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Thomas Kleinman, D.C., D.A.B.C.N.

Great diversity of function is controlled by relatively small volumes of nerve tissue. This economy of spinal neural circuitry is such that it can produce different types of response independently or simultaneously depending on two factors: 1) higher centers that activate the circuitry, and 2) quality and quantity of afferent feedback that modulates the circuitry.[1]

Factual evidence strongly suggests that the atlas adjustment has an effect on the entire nervous system primarily through its effect on joint mechanoreceptors. In order to understand joint mechanoreceptor stimulation, we must review the neuroanatomy and neurophysiology of the synovial joint.

Every synovial joint is subserved by articular nerves in a pluri-segmental fashion, that is, cervical joints are innervated not only from the numerically related spinal nerves, but also from the nerve roots above and below that segmental level. Each of these articular nerves contains a mixture of myelinated and non-myelinated fibers ranging in diameter from 1 to 17 microns.[2,3,4]

The speed of impulse transmission along a nerve fiber is proportional to the diameter of the fiber. The larger the nerve fiber diameter, the faster the transmission of neural impulse. Myelinated nerve fibers transmit faster than non-myelinated fibers.[1]

Postural and kinesthetic realization constitute primary sensory experience. It is the movement of weight bearing joints and the resulting activation of corpuscular mechanoreceptors within synovial capsules and ligaments that provides this vital information. Parent afferent nerve fibers associated with joint mechanoreceptors are the largest in diameter and have the highest velocity of transmission in the body.[3]

Wyke, in 1966, described four types of articular receptors:

TYPE I mechanoreceptors are classified as low threshold and slowly adapting. That means they fire easily and provide a continuous signal throughout the time they are being stimulated. These are by far the most numerous of articular receptors. Type I receptors provide joint positional information whether the joint is moving or not. It is of great importance to the upper cervical adjustor that these receptors are distributed such that they are most numerous on those aspects of the joint capsule that undergo the greatest changes in stress during normal joint motion.

TYPE II mechanoreceptors are low threshold and rapidly adapting. They are activated easily and fire in short bursts when stimulated at the beginning and end of joint movement. They only signal movement and are not active in immobile joints.

TYPE III mechanoreceptors are classified as high threshold, slowly adapting receptors. These receptors are found in ligaments surrounding the joint and are structurally similar to the golgi tendon organ of the muscular system. Type III receptors are inactive in the immobile joint and are only stimulated at the extremes of joint movement, where considerable stress is generated. These receptors continuously fire as long as they are stimulated.

TYPE IV articular receptors are the nociceptors. These are high threshold, non-adapting pain receptors. Under normal circumstances these receptors are completely inactive.[4,3]

One of the functions of articular mechanoreceptors is to provide information depicting the orientation of the different parts of the body with respect to each other in space and gravity. It is a common misconception that the vestibular apparatus of the inner ear plays a major role in this function, for it only provides information as to the location of the head.[5]

Distribution of joint mechanoreceptors is such that the population of receptors is greater per joint, the closer that joint is to the head. The axio-atlanto-occipital joint has a higher concentration of these receptors than any other joint. The most important proprioceptive information needed for maintenance of equilibrium is derived from the joint receptors of the upper cervical spine, appraising the orientation of the head in respect to the body.[4]

Kinesthesis is transmitted from joint mechanoreceptors into the spinal cord through articular afferent nerves which divide as they approach the dorsal root. The larger fibers from the Type I, II, and III receptors carry information to the main sensory tracts of the spinal cord. Ascending the posterior columns to the nucleus cuneatus and nucleus gracilis, this information is carried to the thalamus to be relayed up to the somesthetic cortex (primary sensory for general sensations, depicted by the textbook homunculus) for proprioceptive touch sense and concurrently through secondary fibers to spinal cerebellar tracts providing the cerebellum (responsible for muscle tone and activity, and equilibrium) with proprioceptive sense.[2,3,5]

Information from the joints ascends to the brain via the fastest transmitting fibers thus eventually reaching the thalamus, the cerebellum, and the reticular formation—the three main coordinating areas where afference is compared and an appropriate response is formed.

It has been clinically apparent for years that the upper cervical subluxation produces symptoms and whole body imbalance. The neural component that physiologically explains the consistent clinical findings of the atlas subluxation complex is the reticular formation. In 1968, Dr. Ralph Gregory published the first attempt we can find to explain the "short leg". He stated that the short leg was the result of an innervational overload to the extensor muscles of the same side, producing contracture of anti-gravity musculature.[6] Again in 1973, he wrote of the then recent findings of Magoun regarding the facilitation and

inhibition of motor discharge exerted by the reticular formation.[7]

Due to the proximity of the axio-atlanto-occipital joint to the anatomical textbook description of the reticular formation, chiropractic upper cervical specialists have speculated on various means of mechanical deformation by the subluxation directly to this area of the brain stem.

Brain stem neuroanatomy and physiology and in-depth reviews of recent literature suggest a different and more viable explanation of the process by which the atlas subluxation embarrasses reticular formation activity. This explanation is also consistent with many other long-standing observations connected with upper cervical adjusting.

The reticular formation is a vital center of regulatory nuclei[8], termed a formation because its cell bodies are widespread within the tegmentum of the medulla, pons and midbrain. The neurons of the reticular formation provide a large network of synaptic activity directed both rostrally and caudally along the brain stem.

Important to consider is that axons of reticular neurons: 1) extend the length of the cord, 2) have collaterals that communicate with neurons of other tracts throughout the length of the cord, and 3) may divide into ascending and descending branches acting simultaneously on the cord and mesencephalon. (Figure 1)

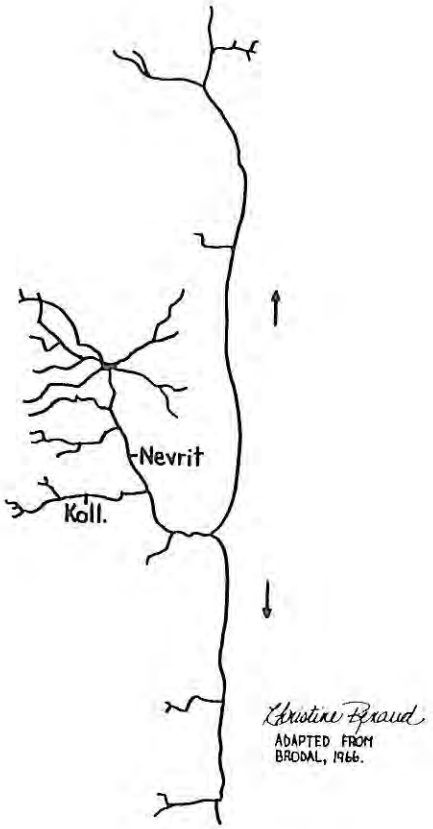


Figure 1

Reticular neuron illustrating ascending and descending axonal projections and a communicating collateral.[9]

All sensory pathways send collateral axons into the nuclei of the reticular formation, regardless of where afferentation is initiated. Efferent activity of the nervous system is response to compared and modulated afferentation, and most efferent discharge is modulated directly by the reticular formation.

Barrios, et al., induced scoliosis in rabbits by performing selective interruption using surgical laser coagulation of intramedullary pathways that mediate proprioceptor input. All rabbits with disruptive damage to these afferent tracts exhibited spinal curvature convex to the damaged sides. These are the same pathways that carry mechanoreceptor input.[10]

Mechanoreceptive afferent input is conducted along the nerve fibers with the greatest velocity of transmission, providing primary sensory experience to the reticular formation for modulation of descending control. Descending control includes:

1) The direct regulation of posture by inhibition and facilitation of synergistic and antagonistic muscle groups, ipsilaterally and contralaterally.
2) Direct regulation of autonomic response.
3) Direct regulation of consciousness, wakefulness and pain as well.[3,4,9] (Figure 2)

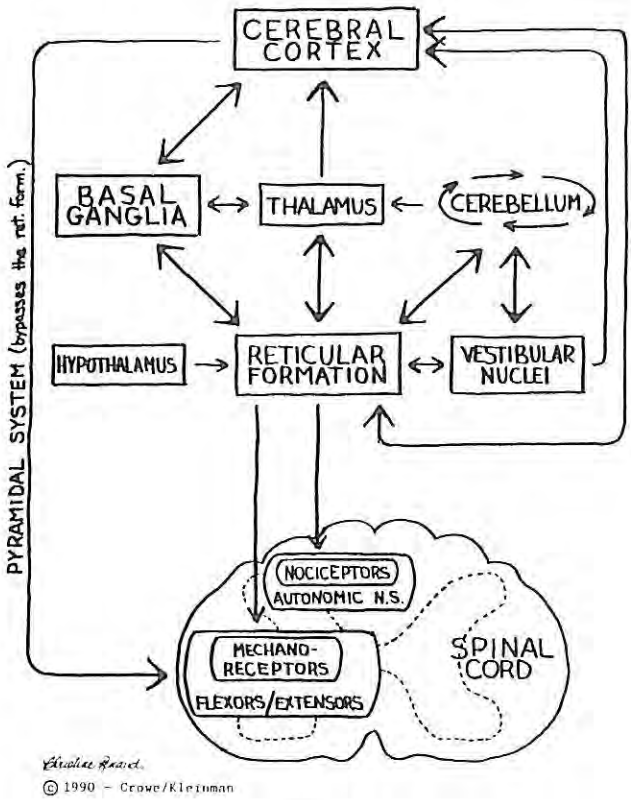


Figure 2

All modes of neural afferentation are compared in circular pathways involving feedback loops that ultimately have synaptic activity in the reticular formation. A central integrative state assures the brain and body self-appreciation and coordinated efferent response.

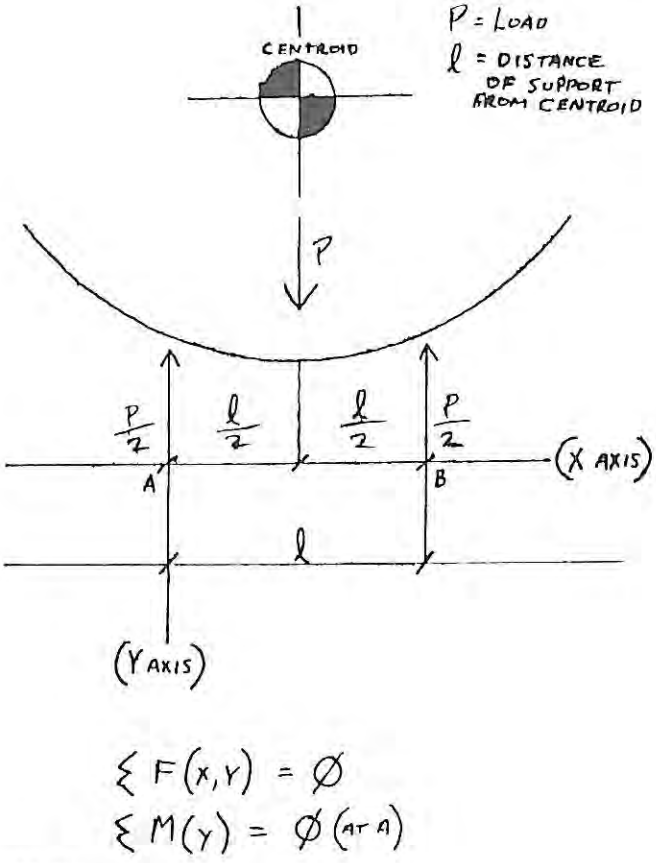


Figure 3

The centroid creates the greatest axial force. Such a critical section requires that the distance of support be equal from the load for equilibrium.[11,12]

It can be concluded that physical disequilibrium and loss of physiologic motion involving a weight-bearing joint supplies irregular input from the primary sensory modality, and that through axo-axonal and axo-dendritic synapses this irregular supply spills over into central nervous system feedback loops and potentially into all body systems. Most weight-bearing joints can recouple by design upon cavitation, but an exception to this rule is the more complex "universal joint" design of atlas-axis which supports the skull bipedally (Figure 3) under the condyles and affords versatile motion of the head. The NUCCA system of adjusting to unbuckle and balance this support (which is by far the richest in population of mechanoreceptors) results in equilibrium, physiologic motion and balanced afferentation by the most neurologically influential joint in regards to awareness of oneself directly, and indirectly to the weight-bearing aspect of the entire skeletal structure.

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REFERENCES

1. Kandel/Schwartz, 1985. Principles of Neural Science, New York, Elsevier, pp. 209-243, 293-294.
2. Dvorak/Dvorak, Gilliar and Greenman, 1984. Manual Medicine—Diagnostics, Stuttgart-New York, Verlag/Thieme-Stratton, pp. 21-26.
3. Wyke, 1979. Neurology of the Cervical Spinal Joints, *Physiotherapy*, Vol. 65, No. 3.
4. Wyke, 1966. *The Neurology of Joints*, Aris and Gale Lecture, Royal College of Surgeons of England.
5. Guyton, 1987. Basic Neuroscience, Philadelphia, Saunders, pp. 197-201.
6. Gregory, July 1968.*NUCCA News*, 6th Ed., National Upper Cervical Chiropractic Association.
7. Gregory, December 1973. *The Upper Cervical Monograph*, National Upper Cervical Chiropractic Association, Vol. 1, No. 2, p. 6.
8. Carrick, 1989. Neurology, American College of Chiropractic Neurology—New York Chiropractic College, Chap. 8, pp 12-16.
9. Pompeiano, 1971. Handbook of Sensory Physiology, Anatomy of the Brain Stem Reticular Formation/Cytoarchitecture and Synaptology, Pisa (Italy), Consiglionazionale delle Ricerche, pp. 382-390.
10. Barrios, et at., 1987. *Spine*, Vol. 12, No. 5, Scoliosis Induced by Medullary Damage: An Experimental Study in Rabbits, Pamplona, Spain, Harper and Row, pp. 433-439.
11. Popov, Mechanics of Materials, 2nd Ed., Problems in Normal and Shearing Stress, pp. 11-13.
12. Beer/Johnston, Mechanics for Engineers—Statics, 4th Ed., Forces in Beams and Cables, p. 268.

Dentate Ligament - Cord Distortion Hypothesis

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ABSTRACT

The mechanism of nerve irritation resulting from upper cervical misalignments has usually involved either the nerve compression hypothesis or the proprioceptive insult hypothesis. Because of the diameter of the canal and the space between the cord and the wall of the canal, compression of the cord at the upper cervical area would require much larger displacements than are encountered in typical patients.

The proprioceptive insult hypothesis does not adequately explain the sensory phenomena experienced by some upper cervical patients and is cumbersome to use in explaining the mechanism behind an upper cervical subluxation causing sciatica.

The Dentate Ligament—Cord Distortion Hypothesis offers a mechanism whereby the effects of misalignments of the upper cervical vertebrae, via the dentate ligaments, produce mechanical distortions of the spinal cord. The clinical significance of the hypothesis and its relationship to supine leg length comparison, low back pain, and trigeminal neuralgia is discussed.

Key Words: *Subluxations, cervical, adjustment, dentate ligament, Grostic technique, neurological hypothesis.*

DENTATE LIGAMENT—CORD DISTORTION HYPOTHESIS

From the time of D. D. Palmer to the present, the neurological component of the subluxation, i.e., interference with nervous system function has been a central tenet of chiropractic.[1-7] Throughout the history of chiropractic various models and mechanisms have been developed to explain how vertebral misalignments produce this interference. These models have ranged from direct mechanical irritation of the spinal nerve or nerve root in the intervertebral foramen to the reflex hypotheses, e.g., somato-visceral, somato-psychic, etc.[8] While many of these hypotheses are credible and some are under investigation at this time, there are still several types of subluxations for which these explanations are inadequate.[5,8]Nowhere is this more apparent than in the upper cervical spine.

In order to explain the upper cervical subluxation the proprioceptive insult hypothesis is usually cited. This hypothesis has been described in detail by Homewood and more recently by Spencer.[5,9] This hypothesis states that the vertebral misalignment (or derangement) produces a hyperstimulation of proprioceptive nerve endings in and adjacent to the articulation. This hyperstimulation results in a barrage of proprioceptive signals into the spinal cord and, it is hypothesized, causes an overload of the integrating circuits of the spinal cord. This results in impairment of spinal cord function at the level of the insult resulting in increased muscle tone around the articulation with possible effects being felt in other areas of the nervous system.[10,11]

The proprioceptive insult hypothesis, plausible as it may be in explaining cord irritation generally, becomes complex when one tries to explain how an upper cervical subluxation can produce symptoms in the lower spine and extremities, e.g., low back pain and sciatica. This hypothesis also fails to explain several of the clinical phenomena associated with the reduction or correction of an upper cervical subluxation.

Chiropractors using exclusively upper cervical adjusting methods have observed sudden and dramatic improvement in some patients with severe low back pain and sciatica. It is not unusual for this to occur almost simultaneously with the adjustment. It is also not uncommon for the patient to experience sensations of warmth (or even occasionally sensations of mild electric shock—Lhermitte's Sign) in the lower extremity simultaneously with the adjustment. Normally these changes and sensations would be considered indicative of spinal cord involvement. While it may be possible to explain these symptoms using the proprioceptive insult hypothesis, I would like to present a relatively new hypothesis.[12-16] which may offer a simpler explanation and provide a useful tool for the understanding of upper cervical sublixations.

The Dentate Ligament—Cord Distortion Hypothesis, utilizes the unique anatomy of the cervical spine to provide

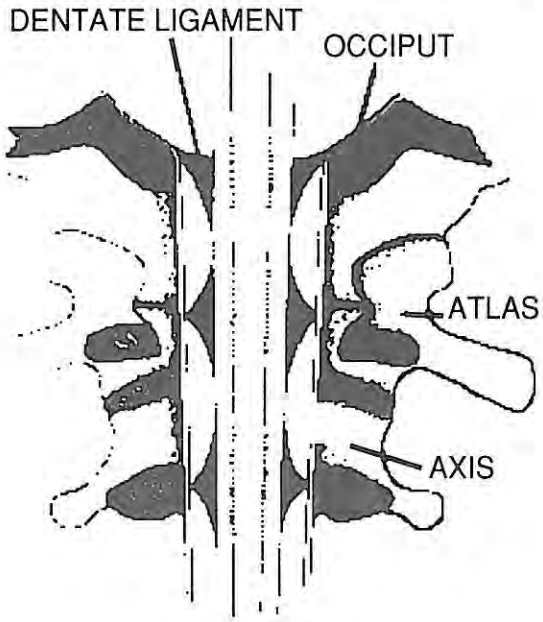


Figure 1

a model which explains how a misalignment of C-1 or C-2 can produce neurological insult directly via mechanical irritation of the spinal cord, and indirectly via vascular compromise of the cervical cord. This hypothesis states that misalignments of the upper cervical vertebrae, because of their unique attachment to the spinal cord by means of the dentate ligaments,[17,18] can directly stress and deform the spinal cord (Figure 1). Subsequently, this stress on the cord, in addition to direct mechanical irritation, may produce venous occlusion with stasis of blood and resulting anoxia in particular areas of the upper cervical cord.[19,20]

This hypothesis combined with knowledge of the mechanics of the cervical spine may provide not only a simpler explanation of nervous system insult resulting from upper cervical misalignments but would appear to be clinically verifiable as well by predicting clinically observable phenomena associated with certain structural misalignments.

There are, however, three direct challenges to this hypothesis which must be answered before it can be accepted as viable:

- First -

IS THE DENTATE LIGAMENT MECHANICALLY LINKED TO THE OSSEOUS STRUCTURES OF THE UPPER CERVICAL SPINE?

- Second -

IS THE DENTATE LIGAMENT STRONG ENOUGH TO DEFORM THE SPINAL CORD?

- Third -

ARE THE OSSEOUS MISALIGNMENTS LARGE ENOUGH TO CAUSE MECHANICAL IRRITATION TO THE CORD?

CHALLENGE ONE

If misalignments of the cervical spine are to affect the spinal cord a mechanical linkage must exist between the osseous structures and the spinal cord. The anatomy of the upper cervical spine reveals several important facts. First, the dentate ligament is a fibrous band of pia mater extending the entire length of the spinal cord on both sides. The lateral border of the dentate ligament presents a scalloped appearance because of toothlike projections which pierce the arachnoid mater and attach to the dura mater.[17,18]

The function of the dentate ligaments has been described by Cunningham's Anatomy as suspending the spinal medulla within the subarachnoid space, but the exact nature of this suspension has been debated in the literature. That the dentate ligaments are responsible for holding the cord in the anterior aspect of the canal, i.e., restricting anterior-posterior motion, as discussed in 1947 by Kahn and in 1954 by Schneider, now seems less certain.[19,21] Stoltmann and Blackwood describe the dentate ligament's ability to transmit axial tensions from the cord to the dura, restricting movement in a cephalo-caudal direction.[22]

Further evidence that the dentate ligaments provide a unique function in the upper cervical region is provided by Key and Retzius who found that the strongest ligaments are the uppermost and that in the upper cervical region they are short, thick, and pass almost perpendicularly from the pia mater to their attachments on the dura mater.[23] The size and strength of the ligaments indicate that they have a restraining function and their orientation is such that they would check vertical movement of the cord.

Between full extension and full flexion of the cervical spine there is a change in the length of the cervical canal of about 30 mm.[24] This is accommodated by some longitudinal compression of the cord during extension and longitudinal stretching of the cord during flexion. Only in the upper cervical area are the dentate ligaments perpendicular to the cord (Figure 2). Based on these observations, it may be a primary role of the upper cervical dentate ligaments to restrict the downward-pulling axial forces created by the lengthening of the canal when the neck is flexed from being transmitted unattenuated to the brainstem.

If the cord were not anchored at the foramen magnum and in the upper cervical area via the dentate ligaments

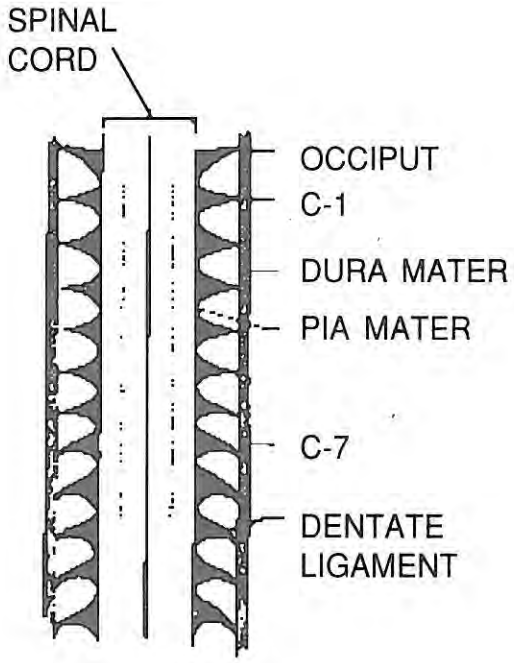


Figure 2

the axial forces produced by normal flexion of the cervical cord would be transmitted to the brainstem pulling downward on the brain. The ligaments thus appear to serve a protective role for the central nervous system during normal movement, but during abnormal movement of cervical vertebrae capable of transmitting pathologic forces to the spinal cord and brainstem.[25]

The spinal cord in the upper cervical spine is firmly attached to the dura mater by the dentate ligaments and the dentate ligaments are attached to the dura mater between nerve roots (Figure 3).[18]There is general agreement that the dura is attached to the skull circumferentially at the foramen magnum, but whether the dura is attached to atlas is unclear in the literature. Gray's Anatomy states that the dura is attached to the foramen magnum, C-2, and C-3 while Cunningham's is silent on any attachment other than to the posterior longitudinal ligament.[17,18]

In a study by Waagen, Lindgren, Miller and Grostic in which frozen transverse 3-5 mm sections were made of the upper cervical spine, numerous strong attachments of the dura mater to the lateral masses and to the posterior arch of atlas were observed (unpublished observation). Similar strong attachments of the dura to the lateral and posterior walls of the canal formed by C-2 were also observed. These attachments appeared to be regular and consistent over several cadavers and there was no evidence of "tenting" of the dura which would indicate adhesions.

CHALLENGE TWO

That the dentate ligament is strong enough to deform the cord is well documented by studies done on the role of the dentate ligament.[23,26] Breig demonstrated that when the cord is stretched in cervical flexion instead of the expected decrease in diameter of the cord, the cord while attempting to reduce its diameter in both the sagittal and coronal planes is restricted from constricting in the coronal plane by the dentate ligaments. The spinal cord is narrowed only in the anterior-posterior direction during cervical flexion because of the laterally located attachments of the dentate ligaments.[27] Thus even in normal flexion the dentate ligaments are strong enough to slightly deform the cord.

While it would appear that the dentate ligament has been shown to slightly deform the cord during normal movement of the upper cervical spine, abnormal movement and misalignments of the upper cervical structures and their resulting effects on the spinal cord via the dentate ligament have yet to be discussed in the literature.

CHALLENGE THREE

Little has been published on the magnitudes of upper cervical misalignments. Bunton described two cases of lateral subluxation of atlas with respect to C-2.[28] In both cases he noted lateral scoliosis of the cervical spine with a reverse tilt of the head back to the midline. While he noted that the articular surface of atlas overlapped the articular surface of axis on one side, the actual size of the misalignment is not discussed.

In 1946, J. F. Grostic presented a means of measuring misalignments in the upper cervical spine.[29] His system measured both lateral and rational displacements of the atlas with respect to the skull as well as lateral and rotational displacements of the atlas with respect to the axis.[15,29] Since that time numerous chiropractic procedures have used the method either in its entirety[30,31] or in modified forms.[32-34] This method utilizes angular measurement to determine the magnitude of vertebral misalignments (Figure 4) because angular measurement is less sensitive to magnification distortion on the x-ray films than some direct displacement measuring systems. Direct displacements can be calculated, however, if one knows the radii of curvatures of the condyle and axial arcs (Figure 4) and applies the following equation:

Equation 1

Displacement = 2 • Radius • PI • Angular Displacement / 360.

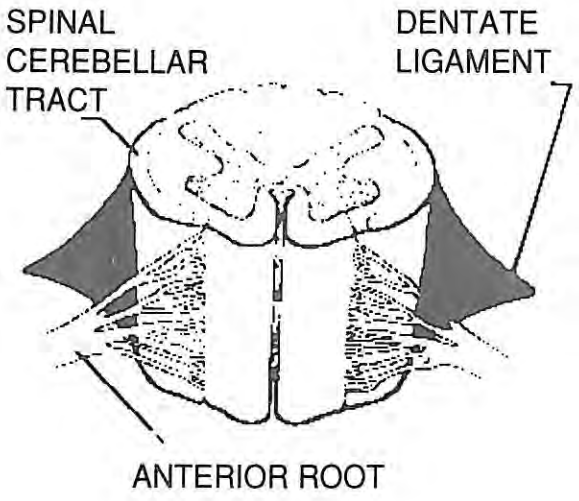


Figure 3

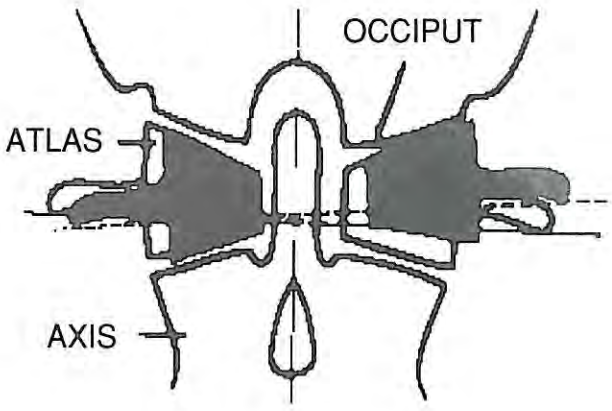


Figure 4

Data from a retrospective study of 523 patients, [36] all of whom had clinical signs of upper cervical subluxations, suggests that the average lateral misalignment between atlas and skull is 3 degrees and the average radius of curvature of the condylar arc is 57.2 mm. From equation 1, the average movement along the condylar surface was 3.0 mm. Because the superior articular surfaces of C-2 are usually flatter (larger radius of curvature) the lateral displacements of C-1 on C-2 can be even greater than the misalignments of C-1 with respect to the skull. With even moderate angular misalignments of C-1 on C-2 it is common for the inferior articular surface of C-1 to overlap the superior articular surface of C-2 (Figure 4).

The calculations above give the actual distance of the movement over the curved surfaces. Under certain circumstances the actual lateral displacement can be very closely approximated by using equation 1. As long as the misalignment angle is less than 10 degrees, the actual lateral deviation and the calculated arc deviation are in close agreement (at 3 degrees the error is less than 0.01 mm.).

With the transverse diameter of the spinal cord at the level of C-1 being about 13 mm, even an average lateral misalignment of 3 degrees producing a lateral displacement of 3 mm would deform the cord by greater than 23% of its diameter if its effects could be transmitted to the spinal cord unattenuated. It is probable that the elasticity of the dentate ligaments dissipates some of this stress, but, as Kahn discussed [19], chronic tension on a ligament may produce thickening and strengthening of the ligament, decreasing the ligament's ability to damp the distortive forces before they can deform the cord.

J. F. Grostic taught, and other chiropractors using Grostic Procedure have since observed that, as a rule, the patient must have a misalignment of 0.75 degrees before neurologic manifestations are noted, i.e., positive supine leg length test (difference in leg lengths of greater than 8 mm).[36] Not all patients begin to show symptoms of neurologic involvement at 0.75 degrees, but from clinical experience this does seem to be about the minimal lateral misalignment to do so. An angular misalignment of this magnitude would produce a lateral movement of almost 0.75 mm. While 0.75 mm may seem so small as to be within the nervous system's ability to adapt, it is interesting to note a study by Jirout in which he measured the maximum anterior-posterior movement of the spinal cord in the sagittal plane at the level of the atlas and found it to be about 4 mm.[37]

Using this maximum distance and the approximate measurements of the atlas as published by Lang [38] it is possible to calculate that the lateral deviation of the cord produced by this motion's shortening effects on the dentate ligament is approximately 0.5 mm. It seems that even at the limits of normal motion the distortion of the cord does not equal that of even the smallest clinically significant misalignment. Traction on the cord by misalignments thus would seem to be significantly larger than those produced by normal movement.

VASCULAR EFFECTS OF MISALIGNMENT

In addition to direct mechanical irritation of the tracts of the spinal cord, this mechanism may involve a vascular component.[20] Gillilan, in an investigation of the venous drainage system of the cervical spinal cord, observed that the small radicular veins of the upper cervical cord were not as redundant as those elsewhere in the spinal cord and that mechanical obstruction of these veins could cause stasis of blood and ischemia in the portion of the spinal cord drained by these veins. She noted that venous stasis would tend to cause ischemia first in the lateral columns of the cord. Gillilan pointed out that because these veins operate at such low pressures, they are easily occluded by compressive forces. She further noted that the dentate ligament may be one means of transmitting mechanical stresses to the cord.

Important to this proposed model is that ischemia first increases the irritability of nerves.[39,40] Thus, a purely mechanical irritation of the nerve tracts may be aggravated by localized ischemia and increased sensitivity to the effects of mechanical irritation.

CLINICAL SIGNIFICANCE

This new hypothesis of neurologic interference may help explain many of the neurological phenomena encountered in clinical chiropractic practice. In light of the Dentate Ligament—Cord Distortion Hypothesis, the structures and tracts of the upper cervical cord take on a much greater clinical significance for the chiropractor.

SUPINE LEG LENGTH TEST (GROSTIC LEG CHECK)

A cross section of the cord at the level of C-1 shows the relationship of the tracts of the cord to the points of attachment of the dentate ligaments (Figure 5). Breig, using araldite (a transparent plastic) showed parabolic iso-force lines were created when compressive forces were applied. While his model was not quantitative, it did provide insight into the way forces resulting from compression may be transmitted within the cord.[41] One would expect that while the force transmission within the cord resulting from tension would be different than that resulting from compression, the iso-force lines would still be in similar patterns and traction on the cord by displaced dentate ligaments would approximate this pattern.

Force distribution alone, however, is not enough to predict where nerve irritation will occur. All tracts do not respond equally to equal mechanical irritation.[42] Tracts with nerves fibers of larger diameter are more sensitive to mechanical irritation,[43] than smaller diameter fibers, e.g., pain fibers.

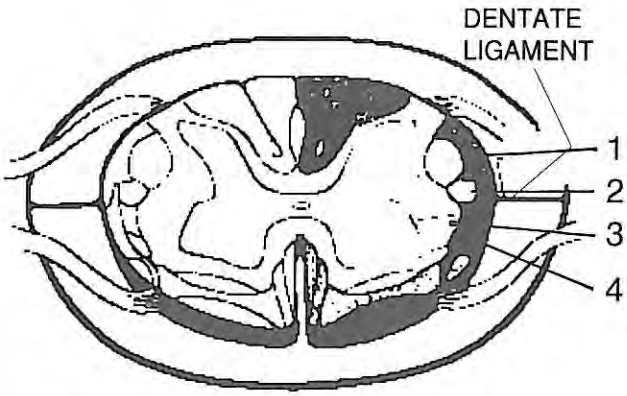
The spinocerebellar tracts are composed of the largest axons in the spinal cord (type A fibers). They are located at the site of maximal mechanical irritation. If traction disrupts cord function it does so first in the spinocerebellar tracts, tracts responsible for muscle tone, joint position sense[44], and the status of interneuronal activity signaling the "internal state" of lower motor centers.[45] The most lateral fibers innervate the most caudal structures.[46] In the dorsal spinocerebellar tract the most lateral fibers innervate

the lower lumbar and sacral area and are acted on monosynaptically by afferents of muscle spindles and tendon organs[45]. The ventral tract's lateral-most fibers may carry information about activity in segmental reflex arcs, segmental paths, e.g., muscle spindle and tendon organ afferents, and Renshaw cells.[47] Involvement of either tract may affect the muscles of the pelvic girdle or the muscles of the lower extremities. It is hypothesized that spinal cord irritation caused by the dentate ligament traction may affect the muscles of the pelvic girdle and lower extremities producing hypertonicity and even spasticity of the involved muscles.

This increased muscle tone in the large muscles of the pelvis and thigh may cause the pelvic distortions manifesting as a functional short leg. In chiropractic there have been numerous attempts to directly measure pelvic distortion. Most recently Gregory developed an instrument to measure the various pelvic distortions that manifest as a short leg.[48] That one of the first tracts of the spinal cord to be influenced by dentate ligament irritation is the spinocerebellar seems consistent both with the anatomical knowledge of the upper cervical spine and with the clinical use of the supine leg length test (Grostic Leg Check) as an indicator of neurologic interference from an upper cervical misalignment.

LOW BACK PAIN RELATED TO UPPER CERVICAL SUBLUXATION

The cross section of the cord (Figure 5) shows that the spinothalamic tract lies close to the dentate ligament attachment points. Like the spinocerebellar tracts, the spinothalamic tracts are organized in laminar fashion with the most lateral fibers corresponding to the sacral and lower lumbar nerve distributions but carrying pain and temperature sensations.[49]



1 - CORTICOSPINAL TRACT
2 - DORSOSPINOCEREBELLAR
3 - SPINOTHALAMIC TRACT
4 - VENTROSPINOCEREBELLAR

Figure 5

Mechanical irritation of the spinothalamic tract in the upper cervical cord caused by traction of the dentate ligament could produce pain in the low back and legs. This may explain some low back pain and sciatica, especially that which occurs in the absence of demonstrable local cause and is relieved almost instantaneously by an upper cervical adjustment. It may also explain the sensation of warmth or mild electric shock experienced in the legs or low back by some patients as they are adjusted in the upper cervical region.

TRIGEMINAL NEURALGIA AND UPPER CERVICAL SUBLUXATIONS

The Dentate Ligament-Cord Distortion Hypothesis may provide an explanation for the efficacy of correction of upper cervical subluxations in relieving trigeminal neuralgia. The paroxysmal nature of the pain indicates that it arises as a sudden discharge of neurons as a result of irritation of the trigeminal nerve or it could occur in the gasserian ganglion or in the spinal nucleus of the trigeminal nerve.[50,51] The spinal nucleus of the trigeminal nerve may extend downward as far as the 4th cervical vertebra.[51,52] By combining anterior rotation of the atlas on the side to which the atlas has laterally deviated with the lateral traction it may be possible to put traction directly on the sensory nucleus of the trigeminal nerve at the level of the first and second cervical vertebrae.

I have cared for a patient with severe trigeminal neuralgia in which rotational misalignment of the atlas appeared to be the most critical factor and required the greatest reduction before relief from the attacks occurred. Direct mechanical-vascular irritation of the spinal nucleus might also explain those cases in which surgical destruction of the ganglion or sectioning of the nerve fails to provide relief.[53,54]

Many additional studies on the effects of upper cervical misalignments on the central nervous system are needed before any firm conclusions can be drawn. Perhaps this hypothesized mechanism may encourage further, much-needed investigation into this important area. While the concept of encroachment of a foramen has explained direct irritation of the spinal nerve or nerve root and has been a basis of chiropractic care for many years, the dentate ligament mechanism may now describe a mechanism by which misalignments in the upper cervical spine can produce direct irritation of the spinal cord. Diagnostic procedures such as magnetic resonance imaging, whereby the spinal cord can be visualized, and studies using 3-dimensional dynamic models of the spine, resembling those of C. H. Suh, whereby dynamic stresses on the cord itself can be analyzed may lead to a greater understanding of the upper cervical subluxation and better procedures to reduce or correct it.[55]

ACKNOWLEDGEMENTS:

I thank Mr. Tom Strine who did the artwork for all of the figures. Thanks also to Drs. Janice Lindgren and Paul Miller for their work in dissection.

REFERENCES

1. Palmer, D. D., Textbook of the science, art, and philosophy of chiropractic for students and practitioners. Portland Printing Company: Portland, Oregon, 1910.
2. Palmer, B. J., The subluxation specific - the adjustment specific. Palmer School of Chiropractic, Davenport, IA, 1934.
3. Janse, J., Houser, R., and Wells, B., Chiropractic Principles and Technic. National College of Chiropractic, Chicago, 1947.
4. Forster, A., Principles and Practice of Chiropractic. National Publishing Association, Chicago, 1923.
5. Homewood, A., Neurodynamics of the vertebral subluxation (Toronto), Canadian Memorial Chiropractic College, 1963.
6. Stephenson, R., Chiropractic Textbook, Privately published by R. Stephenson, Davenport, 1927.
7. Riley, J., Science and Practice of Chiropractic with Allied Sciences. Riley, 1925.
8. Hildebrandt, R., The scope of chiropractic as a clinical science and art: An introductory review of concepts. J Manipul Physiol Therap 1978 1(1):7-17.
9. Spencer, J., The neuropathophysiological relationships between asymmetrical spinal proprioception and postural muscle asynergism. 13th Biomechanical Conference on the Spine. Palmer College of Chiropractic-West, Sunnyvale, CA 1982.
10. Gerren, R., and Luttges, M. W., Pharmacological, morphological, and biochemical examination of spinal cord compensatory mechanisms related to unilateral nerve crush. 9th Annual Biomechanical Conference on the Spine. University of Colorado 1978.
11. Fisher, L. J., and Luttges, M. W., Nerve damage influences upon evoked responses in the spinothalamic tract of mice. 11th Annual Biomechanical Conference on the Spine. University of Colorado 1980.
12. Grostic, J. D., Upper cervical anatomy and the subluxation. Michigan Chiropractic Council Fall Convention. Romulus, Michigan 1972.
13. Grostic, J. D., Grostic procedure part I seminar notes. Grostic Chiropractic Presentations, Atlanta, GA. 1973.
14. Grostic, J. D., The Grostic procedure. The Palmer Beacon. Palmer College of Chiropractic. Davenport, Iowa. June 1976.
15. Grostic, J. D., The origins of the Grostic procedure. International Review of Chiropractic 1978 32:33-35.
16. McAlpine, J., A discussion of the dentate ligament neural traction mechanism. International Review of Chiropractic 1980 34(4):35-9.
17. Romanes, G. J., Cunningham's Textbook of Anatomy 11th Ed. Oxford University Press, London 1978.
18. Warwick, R., and Williams, P. L., Editors Gray's Anatomy, 35th British Ed., W. B. Saunders Co. Philadelphia, 1973.
19. Kahn, E. A., The role of the dentate ligaments in spinal cord compression and the syndromes of lateral sclerosis. Journal Neurosurgery 1947 4:191-199.
20. Gillilan, L. A., Veins of the spinal cord. Neurology 1970 20:860-8.
21. Schneider, R. C., Cherry, G. R., and Pantek, H., Syndrome of acute central cervical spinal cord injury with special reference of mechanisms involved in hyperextension injuries of cervical spine. J. Neurosurgery 1954 11:546-577.
22. Stoltman, H. F., and Blackwood, W., An anatomical study of the role ofthe dentate ligaments in the cervical spinal canal. Journal of Neurosurgery 1960 23:214-21.
23. Breig, A., Biomechanics of the Central Nervous System. Year Book Publishers, Inc. Chicago, 1960, pg 48.
24. Ibid., pg 27.
25. Ibid., pg 49.
26. Tunturi, A. R., Elasticity of the spinal cord, pia, and denticulate ligament in the dog. J. Neurosurg 1978 48:975-79.
27. Breig, A., Adverse Mechanical Tension in the Central Nervous System. John Wiley & Sons, New York 1978 pg. 35.
28. Bunton, R. W., Grennan, D. M., and Palmer, D. G., Lateral subluxation of the atlas in rheumatoid arthritis. British Journal of Radiology 1978 51(612):963-7.
29. Grostic, J. F., Chiropractors field research manual. Private publication (avail. from author), Ann Arbor, MI. 1946.
30. Gregory, R., Manual of upper cervical analysis. National Upper Cervical Chiropractic Association, Monroe, MI 1971.
31. McAlpine, J. E., and Humber, J. K., Chiropractic Orthospinology. Today's Chiropractic 1983 12(2):24-28, 53-54.
32. Pettibon, B.., Pettibon method of cervical x-ray analysis and instrument adjusting. Privately published by B. R. Pettibon, Tacoma, WA 1968.
33. Sweat, R. W., Atlas Orthogonality. Today's Chiropractic 1983 12(2):10-4.
34. Jones, D., Life Cervical Technique. Life Chiropractic College, Marietta, Georgia 1977.
35. Grostic, J. D., and DeBoer, K., Roentgenographic measurement of atlas laterality and rotation: A retrospective pre- and post-manipulation study. J Manipul Physiol Therapy 1982 5:63-71.
36. Grostic, J. F., Grostic procedure seminar notes. Ann Arbor, Michigan. 1946.
37. Jirout, J., The mobility of the cervical spinal cord under normal conditions. British Journal of Radiology 1959 32:744-51.
38. Lang, J., Craniocervico region, osteology and articulations. Neuro-Orthopedics 1986 1:67-92.

39. Gelfan, S., and Tarlov, I. M., Differential vulnerability of spinal cord structures to anoxia. Journal of Neurophysiology 1955 18:170-188.
40. Thompson, I. M., and Kimball, H. S., Effect of local ischemia upon human nerve fibers in vivo. Proceedings of the Society of Experimental Biology and Medicine 1936 34:601-3.
41. Breig, A., Adverse Mechanical Tension in the Central Nervous System. John Wiley & Sons, New York 1978 pgs. 54, 90-95.
42. Gelfan, S., and Tarlov, I. M., Physiology of spinal cord, nerve root and peripheral nerve compression. American Journal of Physiology 1956 185:217-29.
43. Causey, G., and Palmer, E., The effect of pressure on nerve conduction and nerve-fibre size. Journal of Physiology 1949 109:220-31.
44. Gilman, S., Bloedel, J. R., and Lechtenberg, R., Disorders of the Cerebellum. F. A. Davis Co. Philadelphia 1981 pgs. 16-28.
45. Ekkerot, C. F., Larson, B., and Oscarsson, O., Information carried by the spinocerebellar paths. Progress in Brain Research 1979 50:79-90.
46. Lewis, A. J., Mechanisms of Neurological Disease. Little, Brown and Co. Boston 1976, pg. 107-8.
47. Gilman, S., Bloedel, J. R., and Lechtenberg, R.., Disorders of the Cerebellum. F. A. Davis Co. Philadelphia 1981 pgs. 21-28.
48. Gregory, R., NUCCRA Research-The Anatometer. The Upper Cervical Monograph 1976 1(10):1-5.
49. Chusid, J. G., Correlative Neuroanatomy & Functional Neurology. Lange, Los Altos, CA. 1973.
50. Gilroy, J., and Meeyer, J. S., Medical Neurology. MacMillan Publishing Co. New York, 1979.
51. Adams, R. D., and Victor, M., Principles of Neurology. McGraw-Hill New York, 1985, pg 144.
52. Lewis, A. J., Mechanisms of Neurological Disease. Little, Brown and Co. Boston 1976, pg. 107-11.
53. Merritt, H. H., Merritt's Textbook of Neurology. Editor Ed Rowland Lea & Febiger Philadelphia 1984 pg 321.
54. Breese, R., and Ignelzi, R. J., Microvascular decompression for trigeminal neuralgia. Journal of Neurosurgery 1982 57:487-490.
55. Suh, C. H., Analysis of a three dimensional multi-rigid-body dynamic model for spinal systems. 10th Annual Biomechanical Conference on the Spine. Palmer College of Chiropractic, Davenport, IA 1979.

A NUCCA Data Base for 17 Parameters for both Pre-adjustment and Post-adjustment

By Laurence Nigron

A compilation of pre-adjustment data based on original x-rays was completed by Dr. Laurence Nigron, a recent graduate of Palmer College, who is now living in the Oakland area of California. Dr. Nigron took the 17 variables which are used by NUCCA practitioners, and transformed the data into orthogonal measurement for the computer at Palmer College. Ninety-nine cases were used.

Dr. Nigron was a student when she submitted this work, so she was presented with a check for $250 from the NUCCA scholarship awards fund. Dr. Nigron was a member of the first class that graduated from Palmer College who took the NUCCA work taught by board certified NUCCA instructors.

Dr. Nigron is a native of France.

The compilation of post-adjusted data based on the "results" of the first adjustment was completed by Dr. Michael Thomas, a 1990 graduate of Palmer College. Dr. Thomas is now doing a residency in association with Dr. Keith Denton of Monroe, Michigan.

The adjusting doctor for all cases was the late Dr. Ralph R. Gregory. All readings were taken from notations on marked x-rays; in several cases where x-rays were not marked, patient files were referenced.

All anatometer readings and x-rays were taken by Dr. Teresa Palmer and Dr. Keith Denton, both NUCCA board certified doctors.

NUCCA would like to publish this data base in its entirety in the near future.

LETTERS TO THE EDITOR

Occipital-Axial Relationships

By Steven Goodman, D.C.

DEDICATION

The years 1977-1980, were memorable ones in my life. It was a fortunate time, observing and assisting Dr. Gregory. This article and future papers are a reflection of the many observations gleaned from the genius that was Dr. Gregory.

OBSERVATION #1

In normal cervical motion, the axis spinous rotates in the opposite direction of the laterally tilted skull, i.e., upon right lateral flexion of the skull, the axis will rotate to the left. Dr. Gregory observed that in a Type II subluxation, the axis spinous rotates to the side of the turned-in skull.[1] The turning-in of the skull in the frontal plane, is biomechanically distinct from lateral flexion. When the skull turns-in and the atlas subluxates, the axis spinous will (with few exceptions) rotate to the side of the subluxation. Having closely observed this phenomenon for four years, I have found few exceptions to this important finding.

OBSERVATION #2

The correction of axial subluxations is simplified by the understanding of the various occipital/axial relationships. In type I subluxations, axial rotation is usually not substantial because the majority of the C1 subluxation in the frontal plane is produced by the shifting of atlas upon occiput. The skull in a type I is not exerting a great downward force upon the axis. In types II and IV, it IS the downward weight of the skull on the axial surface that encourages it to rotate into the subluxation. Type III in my opinion, is a transitional position, and not a true type.

OBSERVATION #3

The correction of axial rotation is directed at lifting the great weight of the skull off C2, and establishing normal centers of motion. As the skull comes out of the subluxation, so will axis rotation, torque being an added impetus to facilitate motion. The apparent dilemma in establishing the correct vector to reduce type IV subluxations is simplified with the understanding that the opposite lower angle is in response to a rotated axis, and is the effect of angular rotation, and not the cause. In other words, adjusting from a low vector will not only correct the occipital/atlantal subluxation, but will also correct axial rotation, which simultaneously affects C3, C4, C5, etc. The amount of angular rotation left on the post x-ray is directly proportional to the outstanding axial subluxation.

OBSERVATION #4

In my opinion, the angular rotation of the cervical spine is the outcome of altered upper cervical weight distribution and is not the instigator of C1 subluxations, as previously thought. The large mass of the head on the vulnerable atlas makes it a prime candidate for subluxation. Most of my patients relate "symptomatic" loss of their adjustments after getting their heads in precarious positions. Auto accidents, sport injuries, chiropractic manipulation, blows to the head, etc., are some examples of head injuries that deliver sufficient force to upset the incredibly delicate upper cervical relationship. I believe that angular rotation, by itself, is not sufficient cause for the C1 subluxation. For example, many scoliotic individuals with angulated cervical spines are able to maintain balance in spite of their deformity.

A CHALLENGE

In an effort to complete my clinical investigations of occipital/axial relationships, I am seeking x-rays that disprove the "rule" that axis spinous turns to the side of the turned in skull. If anyone comes up with a set of x-rays (pre and post) that are contrary to my findings, please send me the films. Remember, axial rotation as viewed on a nasium, must be confirmed on the vertex.

In conclusion, I look forward to repeated dialogue in NUCCA and encourage others to contribute. Dr. Gregory is no longer with us, but his life serves as an inspiration to all who practice our art and science.

(1)personal communication

EDITOR'S RESPONSE:

The editor wishes to thank Dr. Goodman for his thoughtful letter entitled, "Occipital-Axial Relationships." In response to Dr. Goodman's observations we have examined our most current database which includes head tilt, based on x-ray analysis by Gregory. Our research board certainly feels that a database of 99 consecutive cases is inconclusive and should be in the range of 5,000 to 10,000 cases to make definitive conclusions. Analysis of this data does support some of Dr. Goodman's observations and indicates the following:

In basic type 1 misalignments, 47.2% of spinous rotations were misaligned away from the side of head tilt. 13.2% of spinous rotations were to the side of head tilt, indicating a small influence of head tilt on spinous rotation of C2. 39.6% had no head tilt.

In basic type 2, 60.8% of spinous rotations were to the side of head tilt and 21.7% of spinous rotations were away from the side of head tilt. 17.4% of cases had no head tilt even though classified as a second basic type.

Although Dr. Goodman refers to basic type 3 as a "transitional phase," 100% of spinous rotations were to the side of head tilt. In basic type 4, 80% of spinous rotations were to the side of head tilt and 20% were opposite.

Although not quite the percentages that Dr. Goodman implied, head tilt, specifically the shift in center of gravity of the skull, may have an influence on spinous rotation.

Dr. Goodman's observations that spinous rotations on basic type 1 were smaller than spinous rotations on basic types 2 and 4 were not substantiated by our database.

Basic type 1 spinous rotation ranged from zero to 13.5 degrees with an average of 3.6 degrees. Basic type 2 spinous rotation ranged from zero to 7.0 degrees with an average of 3.6 degrees. Basic type 4 spinous rotation ranged from one degree to 5.0 degrees, with an average of 3.0 degrees. Basic type 3 supported Dr. Goodman's observations the most with spinous rotations ranging from zero to 9.0 degrees with an average of 4.3 degrees.

As for observations three and four, it is NUCCA's position that angular rotation cannot be discounted in selection of height vectors and headpiece placement. We do agree with Dr. Goodman that a lowering from the computed height vector with corresponding changes in headpiece placement, will aid in correction of the basic type 4 misalignment. To assume that a "low vector" is always appropriate is misleading. NUCCA still maintains that angular rotation is the precursor to upper cervical misalignments in basic types 1, 2 and 4. This does not conflict with Dr. Goodman's observations that shifts in the center of gravity of the skull may influence C2 rotations. This position is in direct conflict with Dr. Goodman's conclusion that angular rotation is a response to head tilt.

We do appreciate Dr. Goodman's observations and will direct his observations to the NUCCRA board for further study. The editor of the *Monograph* welcomes and encourages this type of dialogue.

NUCCA NEWS

Published by: **THE NATIONAL UPPER CERVICAL CHIROPRACTIC ASSOCIATION, INC.**

NUCCA/NUCCRA Calendar of Events

February 2, 3, 1991	NUCCA/NUCCRA Board Meeting Long term planning session San Diego, California
March, 1991	Monograph
May 4-7, 1991	25th Annual Conference Holiday Inn French Quarter Perrysburg, Ohio
August	Palmer College of Chiropractic Homecoming Davenport, Iowa Dr. A. Berti
July 15, 1991	Monograph Authors' Deadline
August, 1991	Monograph
October 12-15, 1991	NUCCA Fall Conference Life Chiropractic College - West San Lorenzo, California
November-December, 1991	NUCCA Elective Course Palmer College of Chiropractic Davenport, Iowa
December 7, 8, 1991	The 8th Annual Upper Cervical Conference Life Chiropractic College Marietta, Georgia

Dickholtz, Palmer Attend Seventh Annual Upper Cervical Conference

The Seventh Annual Upper Cervical Conference was hosted by Life College, School of Chiropractic in Marietta, Georgia, on December 1-2, 1990. This was the fifth year that Life College acted as host college for the conference. Dr. John Grostic, director of research at the Sid E. Williams Research Center at Life College, was moderator for the conference.

A number of interesting papers were given and a few of these are mentioned here. Dr. L. Hospers (Ph.D., D.C.), previous research director at National College and now a researcher at Life College, presented, "Brain Mapping Observations of Head Injured Subjects Before and After Life Upper Cervical Adjustment". Correlation in time with E.E.G. pattern before and after adjustment were shown and were obvious to the audience. Life College students C. Wehrenberg and T. Mulhall each presented papers on case studies involving pre- and post-adjustment electroencephalography which directly complemented the paper by Dr. L. Hospers; one of these two papers showed pre-adjustment, adjustment and post-adjustment results. Dr. R. Hosek (Ph.D. D.C.), a researcher at Life College, and Dr. D. Glick (D.C.) presented, "Evoked Potential Changes Seen with Upper Cervical Spine Adjusting: A Pilot Study". Doctors H.S. Crowe, T. Kleinman, and J. McAlpine each gave presentations directly related to neurology/neurophysiology.

Dr. R. Sweat (D.C.) presented "Videofluoroscopic Studies of Axis Spinous Rotational Movement on the Horizontal Plane"; this paper apparently challenged some published medical research and was lively debated by Dr. D. Harrison (D.C.).

N.U.C.C.A. was well represented by Dr. Marshall Dickholtz, Sr. who presented a paper titled, "Maintaining or Improving the Quality of X-ray Films While Minimizing Patient Exposure" and by Professor J. Palmer, University of Toledo, who presented, "A Clinical Investigation Into Upper Cervical Biomechanical Stability — A Pilot Study". Both presentations were well received with numerous questions from Conference attendants.

The Eighth Annual Upper Cervical Conference will be held December 7 and 8, 1991, at Life College School of Chiropractic. Papers are to be submitted for consideration and if accepted, inclusion in published form. N.U.C.C.A. members are encouraged to support future conferences either by attendance or presentation of papers.

NUCCA Certification

A certification program has been initiated by the National Upper Cervical Chiropractic Association, Inc. (NUCCA). The purpose of the program is to NUCCA-qualify doctors in the NUCCA work and establish a set of standards for all NUCCA doctors to maintain. Doctors who successfully complete the program will be eligible to qualify as instructors in the NUCCA procedures. Examinations will be given at NUCCA seminars and conventions. Doctors who desire to take the examinations must make application to the certification committee one month prior to the seminar or convention date.

Doctors who wish to be NUCCA-certified must meet the following prior conditions: (1) be in practice for a period of at least three years; (2) have possession of, or access to, equipment and instrumentation recommended by NUCCA; and (3) permit NUCCA inspection of their office facilities. The entire examination must be completed within a three year period. Certificates will be issued to successful candidates.

Doctors who have not engaged in practice for three years but who have attended NUCCA seminars are eligible to take the examination or examinations which cover a three year period. A fee is charged for each examination. There are three examinations which must be passed in order to become certified. In the event of failure of the examination, or any part thereof, the candidate is re-examined on the part of the examination that is failed without paying an additional fee, provided re-examination takes place within a one year period.

Certification will be evaluated every three years and certified doctors will be requested to either take an oral examination on updated data or provide evidence that they have attended a NUCCA seminar at least once each year.

The examination is in three segments, as follows:

1. X-RAY AND INSTRUMENTATION
   - A. Understanding of x-ray alignment procedures
   - B. Theory about distortion, magnification, collimation
   - C. Produce five sets of consecutive pre-cervical x-rays suitable for analysis
   - D. Submit a set of x-ray alignment films as designated by NUCCA x-ray outline
   - E. Examination on x-ray procedures
   - F. Examination on instrumentation

   Parts A and B are a written examination composed of one hundred questions with a passing grade of 85. The practical portion, Parts C, D, E, and F cannot be taken until the written part is successfully completed.

   The fee for Segment 1 is fifty dollars and must be included with the application.

2. FILM ANALYSIS, BIO-MECHANICS AND ADJUSTING
   - A. Knowledge of osseous structures, bio-mechanics and adjusting. Written examination of 100 questions. Passing grade of 85.
   - B. Submit five consecutive pre-sets of analyzed cervical spinal x-rays. The analysis must be the analysis outlined by NUCCA. The x-ray analysis must pass an inter-observer reliability of .90.
   - C. Examination of film analysis.

   Parts B and C can not be submitted or taken until Part A is passed. X-ray sets from Segment 1 cannot be submitted for Segment 2.

   The fee for Segment 2 is one hundred dollars and must be included with the application.

3. ADJUSTING
   - A. Submit ten sets of consecutive pre and post cervical x-rays. The post x-rays presented to the examining board should be those taken after the initial adjustment. Reduction in the misalignment factors must be 85% or better. Reduction in cases of gross or normal misalignment factors to be evaluated at the discretion of the examining board.
   - B. Submit an outlined work-up for each of the above set of x-rays. The work-up outline is to be requested from the examining board.
   - C. Oral examination in which the candidate is given various listings for which he is to explain reduction procedures.

   The ten sets of x-rays submitted cannot be x-ray sets from Segments 1 and 2.

   The fee for Segment 3 is one hundred dollars and must be included with the application.

Each Segment must be successfully completed before application can be made for the following Segment examination.

Application for certification examinations must be submitted one month prior to seminar or convention date to:

Dr. Albert Berti
200 - 3825 Sunset Street
Burnaby, B.C., Canada
V5G 1T4

Executive Director Visits Life West Chiropractic College

Dan Seemann visited the Life West Chiropractic College campus October 12 to confer with Life West officials about future NUCCA seminars to be held at the college, and how NUCCA might assist the instructors who are now teaching the NUCCA work at the college. Dr. Seemann also spoke to members of the NUCCA club about some of the current NUCCA research.

On October 13, in San Lorenzo, Dr. Seemann and Dr. George Wentland presented a check to Dr. Laurence Nigron for her research as a student at Palmer College. Her article is published in the current *Monograph* and deals with the computerization of patient data which will be extremely helpful in establishing a NUCCA data base.

Dr. George Wentland hosted the executive director's trip to the west coast which allowed Dr. Seemann an opportunity to visit with several NUCCA members in the San Francisco area. Some of the highlights were having dinner with George Anderson and his wife, and visiting Dr. Zebelin's office in San Francisco. Dr. Anderson was one of the co-founders of Life West Chiropractic College. Dr. Zebelin is currently lead instructor at the college.

The 1990 NUCCA Fall Seminar

The 1990 NUCCA Fall Educational Conference was held at the French Quarter Holiday Inn in Perrysburg, Ohio on October 27-30th. The new locale provided an excellent environment for the varied activities of lecture, demonstration, practice, biomechanical study and slide presentations. The seminar was well attended by doctors as well as students. Fifteen people took the basic course which has been expanded to two full days of instruction. The basic course instructors were Drs. Keith Denton, Lonnie Pond, and Wayne Clark.

The educational program was under the supervision of Daniel C. Seemann, Ph.D., professor emeritus at the University of Toledo, and James F. Palmer, M.S., also a professor at the University of Toledo.

As always, our instructors continue to refine the teaching of this work, making it more accessible to all of those who come to learn. The instructors at this seminar included: Drs. Al Berti, Lloyd Pond, Marshall Dickholtz, Keith Denton, Lonnie Pond, Ed Stein, Wayne Clark and Gordon Hasick.

Of particular note, Dr. Berti in his presentation of biomechanics, and Dr. Pond in his presentation on adjusting, both presented new material. In addition, Dr. Dickholtz gave an exceptional lecture on errors in x-ray placement and their effect on adjusting.

NUCCA Scholarship Awards

The NUCCA Board has approved the continuation of the $250.00 dollar scholarship grant-in-aid for another two years, this sum to be paid to any chiropractic student currently enrolled in a chartered college of Chiropractic who submits to the **Monograph editor** an article pertaining to the upper cervical spine.

Submitted articles may deal with any aspect of the occipital-atlanto-axial area of the cervical spine: mechanics, neurological manifestations, analyses of cervical subluxations, detrimental effects of upper cervical subluxations on the human organism, and the like.

All entries will be judged by the NUCCA Directive Board and by Dr. Daniel C. Seemann of the University of Toledo. Their judgement will be final. Acceptable articles become the property of the NATIONAL UPPER CERVICAL CHIROPRACTIC ASSOCIATION, INC. (NUCCA). Winners will be announced at the following NUCCA convention.

NUCCA will attempt to return all submitted manuscripts that are accompanied by a self-addressed, stamped envelope. NUCCA will not be responsible for lost or mislaid material.

Further information is available by writing the Monograph editor, 217 West Second Street, Monroe, Michigan 48161.

NUCCA Palmer Elective Course Scholarship Awards

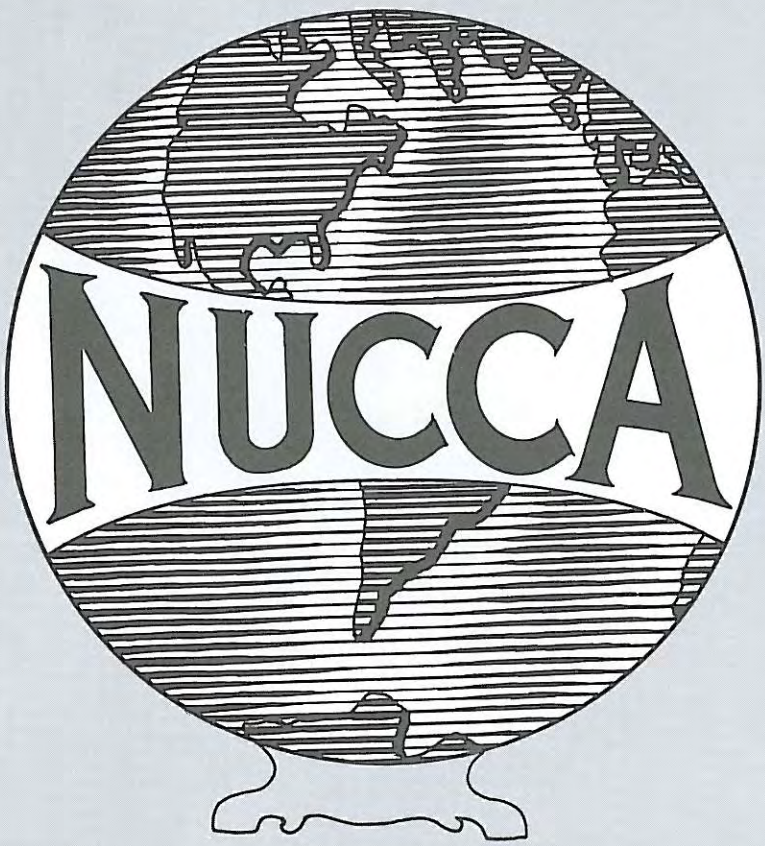
The NUCCA elective course at Palmer College of Chiropractic was considered one of the best ever. The four weekend course held in November and December, 1990, presented the basic or introductory work of the NUCCA organization. Topics covered were: X-ray analysis, x-ray patient placement, adjusting, biomechanics, headpiece placement, and leg checking exercises.

Instructing for NUCCA were Drs. Denton and Lonnie Pond, Berti and Dickholtz, Sr., Lloyd Pond and Schrock, and Stein and Palmer.

The board of directors of NUCCA and the NUCCA instructors were very pleased with the quality and dedication of the Palmer College students. Scholarship awards were presented to three outstanding participants, chosen by the instructors. Award winners were: Bob Gilbert, Todd Sands, and Dr. Mary McConnell. Upon completing the course, Palmer students may use the NUCCA procedure in the Palmer Clinic.

The next elective course will be presented during the fall of 1991. The board of directors wishes to express its thanks to the Palmer College of Chiropractic Special Programs department for all its valuable assistance.

The 25th Annual Conference



Celebrating 25 years of Excellence in Chiropractic, Education, Research and Patient Care. Dedicated to advancement, preservation and perpetuation of Chiropractic as a healing art.

1991 NUCCA SPRING CONFERENCE

Holiday Inn French Quarter, Perrysburg, Ohio

MAY 4-7, 1991

ADVANCED DOCTORS SCHEDULE

SAT. MAY 4	SUN. MAY 5	MON. MAY 6	TUES. MAY 7
8:00-9:00 REGISTRATION	8:00-9:00 VIDEO: ADJUSTING THE A.S.C.	8:00-9:00 VIDEO: BIOMECHANICS OF THE FOUR BASIC TYPES	8:00-9:00 VIDEO: ADJUSTING THE A.S.C.
9:00-9:30 OPENING REMARKS	9:00-10:30 ADJUSTING-ROLL-IN & TRICEPS PULL (Pond)	9:30-10:30 HEADPIECE PLACEMENT (Berti or Denton)	9:00-11:00 MANAGEMENT OF THE N.U.C.C.A. PRACTICE (Hasick)
9:30-11:00 ADVANCED ADJUSTING LECTURE AND PROBLEM	10:45-12:00 DOCTORS CHOICE	10:45-12:00 DOCTORS CHOICE	11:00-12:00 SEMINAR SUMMARY (Staff)
11:00-12:00 DOCTORS CHOICE			
12:00-1:30 LUNCH	**12:00-1:30 LUNCH**	**12:00-1:30 LUNCH**	
1:30-3:15 X-RAY ERROR & THE EFFECT ON ADJUSTING (Dickholtz, Sr.)	1:30-3:00 RESEARCH UPDATE THE NEXT 10 YEARS (Seemann & Palmer)	1:30-3:00 DOCTORS CHOICE	
3:30-5:00 DOCTORS CHOICE	3:15-5:00 DOCTORS CHOICE	3:00-5:00 N.U.C.C.A. ANNUAL BUSINESS MEETING (bylaw changes)	
7:00 EVENING PROGRAMS			
7:00 VIDEO: X-RAYS ANALYSIS	7:00 N.U.C.C.A. BANQUET	7:00 VIDEO: ERRORS IN ADJUSTING THE A.S.C.	
7:00 CERTIFICATION EXAMS: Candidates must notify Dr. Berti 30 days in advance.		N.U.C.C.A./N.U.C.C.R.A. BOARD MEETINGS	

DOCTORS CHOICE: The D.C. may choose one of the following:

- X-ray Analysis
- Advanced Biomechanics
- Basic Biomechanics
- X-ray Patient Placement
- Adjusting
- Leg Check Exercises
- Headpiece Placement

SUMMARY OF HOURS

Lecture - 12
Doctors Choice - 8.5
Research - 1.5
Films Lectures - 7

*All Instructors are N.U.C.C.A. Board Certified or have candidate status

NEW DOCTORS SCHEDULE

MAY 4-7, 1991

SAT. MAY 4	SUN. MAY 5	MON. MAY 6	TUES. MAY 7
8:00-9:00	8:00-9:00	8:00-9:00	8:00-9:00
REGISTRATION	VIDEO: ADJUSTING THE A.S.C.	VIDEO: BIOMECHANICS OF THE FOUR BASIC TYPES	VIDEO: ADJUSTING THE A.S.C.
9:00-9:30	9:00-10:30	9:30-10:30	9:00-11:00
OPENING REMARKS	BEGINNING ADJUSTING	HEADPIECE PLACEMENT OF THE FOUR BASIC TYPES (Berti or Denton)	MANAGEMENT OF THE N.U.C.C.A. PRACTICE (Hasick)
9:45-12:00	10:30-12:00	10:45-12:00	11:00-12:00
X-RAY ANALYSIS (Denton or Cripe)	PATIENT PLACEMENT FOR CERVICAL X-RAY SERIES	DOCTORS CHOICE	SEMINAR SUMMARY (Staff)
12:00-1:30 LUNCH	**12:00-1:30 LUNCH**	**12:00-1:30 LUNCH**	
1:30-5:00	1:30-3:00	1:30-3:00	
X-RAY ANALYSIS CONTINUED	RESEARCH UPDATE THE NEXT 10 YEARS (Seemann & Palmer)	DOCTORS CHOICE	
	3:15-5:00	3:00-5:00	
	LEG CHECK PROCEDURE ANATOMETER EXAM	N.U.C.C.A. ANNUAL BUSINESS MEETING (bylaw changes)	
7:00 EVENING PROGRAMS			
7:00	7:00	7:00	
VIDEO: X-RAY ANALYSIS	N.U.C.C.A. BANQUET	VIDEO: ERRORS IN ADJUSTING THE A.S.C.	

DOCTORS CHOICE: The D.C. or student may choose one of the following:

- X-ray Analysis
- Advanced Biomechanics
- Basic Biomechanics
- X-ray Patient Placement
- Adjusting
- Leg Check Exercises
- Headpiece Placement

The 25th Annual
National Upper Cervical Chiropractic Association Convention
Co-Sponsored By Palmer College of Chiropractic

The National Upper Cervical Chiropractic Association and Palmer College of Chiropractic proudly present the 25th Annual Educational Conference, to be held at the conference facility of the Holiday Inn French Quarter, 10630 Fremont Pike, Perrysburg, Ohio. The conference runs from 9:00 a.m. Saturday, May 4 through 12:00 p.m. Tuesday, May 7, 1991.

Supervising the conference will be Daniel C. Seemann, Ph.D., The University of Toledo and James F. Palmer, M.S., The University of Toledo. Both Professors are members of N.U.C.C.A. and N.U.C.C.R.A. Conference coordinator is Dr. Keith Denton. Convention chairman is Dr. Otto Portman.

Special emphasis for advance doctors will be biomechanics and headpiece placement of the four basic types and out of pattern subluxations. Subjects will also include: vectorial adjusting, resistances in the C-1 subluxation, leg checking exercises, x-ray machine and patient alignment. New doctors and students will be separated from advanced doctors for the first two days, with emphasis on x-ray analysis, adjusting, x-ray placement, and leg checking exercises.

License renewal is applied for in most states. Not all states approve all courses; therefore, you should check with your own state to see if individual courses are acceptable for license renewal. Participants at the conference who require license renewal must have their license number and be monitored each session.

Professional fees are $450.00; doctors in practice for two years or less, $250.00; and students are $150.00. Registration deadline is March 15, 1991. A $25.00 fee is added for late registration. A non-refundable deposit of $50.00 will hold your reservation. Please make checks payable to Palmer College of Chiropractic, but send checks to N.U.C.C.A., 217 West Second Street, Monroe, MI 48161. Phone 313-241-6923 or 313-241-5755.

Contact: Edna L. Denton
Executive Secretary

1991 SPRING APPLICATION FORM

Name _____ _____ **Check Here If This Is Your 1st NUCCA Seminar**

Address _____ Zip _____

Years in Practice _____ Student _____ School _____

DEADLINE: MARCH 15, 1991

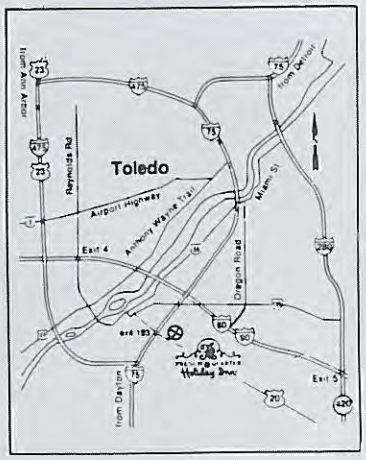
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Mail to N.U.C.C.A., 217 West Second Street, Monroe, Michigan 48161

Please make your own motel reservations, 419-874-3111.

_____ Will or Will not _____ attend the complimentary banquet on May 5, 1991.

_____ Number of guests



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NOTICE

The NUCCA Board of Directors has decided to make the NUCCA collection of video tapes available to members. The price for tapes has been set at $100.00 per classroom hour. The entire set may be purchased for a discounted price of $795.00, or individual tapes may be purchased at prices listed below. Available titles include:

Osseous Structure Identification (45 min.) ....$ 90.00
This tape depicts the various bony structures involved in the NUCCA x-ray analysis. Included are structures that present analytical problems. X-rays of live and dry specimens are used.

NUCCA X-ray Analysis (60 min.) $100.00
Step by step procedure of the NUCCA analysis using x-rays of live specimens.

Leg Check and Headpiece Placement (45 min.) .....$ 90.00
Leg Check describes the planes of reference and how to align the examiner's body for accurate checking. Models and patient used. Errors are discussed. *Headpiece Placement* briefly describes the biomechanics of the correction of the four basic types. Center of Gravity of the skull and its placement on the three types of headpieces is shown.

Adjusting the A.S.C. (3½ hrs.) $300.00
Step by step procedures used to align the adjuster's body in addressing the various A.S.C.s. Includes the most common errors in each phase. Outline of video follows early *Monographs,* Vol. 1 No. 3 through Vol. 2 No. 4. Film includes various steps for posterior rotations and low vector listings.

Errors in Adjusting the A.S.C. (2 hrs.) $200.00
Complements *Adjusting the A.S.C.* This tape describes errors in adjusting, what causes them, and how to correct them.

Patient Placement For X-ray (45 min.).....$ 90.00
Precision placement of the patient for the lateral, vertex, and nasium views are discussed.

X-ray Alignment (45 min.) .....$ 90.00
Step by step procedure used to align cervical x-ray equipment to N.U.C.C.A. standards. To be used with the N.U.C.C.A. X-ray Alignment booklet.

Biomechanics of The Four Basic Types (1 hr.) $100.00
Detailed discussion of the production and correction of The Four Basic Types of A.S.C.s. Headpiece placement and lever system shown in detail.

Questions And Answers, A Self Evaluation For Adjusting The A.S.C. (1 hr.) $100.00
Follows Monograph Vol. 3, No. 9 and No. 10. A chronological order as a guide for the adjuster when practicing the C-1 or triceps pull adjustment. By self-questioning, based on this tape, the adjuster is alerted to the adjusting steps he/she may have neglected or does not know, and the order in which the steps should be performed.

High quality video tapes have been used for reproduction, which carry a lifetime guarantee. Please specify BETA or VHS. Allow 4-6 weeks for delivery. Prices are subject to change with cost of reproduction.

NOTICE

Five patient education pamphlets are now available from NUCCA. The cost is $30.00 per hundred which includes postage and handling. All pamphlets must be paid for in advance due to our non-profit status.

1. *A Patient Guide,* (yellow), explains step by step office procedure to new patients.

2. *Questions and Answers,* (yellow), answers questions most frequently asked.

3. *A Patient Guide,* (green), explains what every patient should know.

4. *The Adjustment and the Patient,* (blue), explains the adjustment and how it works.

5. *The NUCCA System of Chiropractic,* (white), for patients, doctors, and students, explaining the NUCCA system.

Three new booklets have been published by NUCCA. The first booklet details the NUCCA x-ray analysis procedure: *The NUCCA Basic Course: X-ray Analysis;* the second booklet, *The NUCCA Advanced Course: Biomechanics,* explains the biomechanics of The Atlas Subluxation Complex, and the third booklet, *The NUCCA Course: Adjusting The Atlas Subluxation Complex* details the phases and steps of the C1 adjustment and explains *The Standing Positions.* A glossary of terms is included.

Each booklet sells for $15.00.

The Ralph R. Gregory/ Ruth O. Gregory Research Funds

The Board of Directory of NUCCRA voted to combine the Ralph R. Gregory and the Ruth O. Gregory Memorial Research Funds. The perpetual funds shall be used to further research projects as deemed appropriate at the discretion of the Board of Directors of the National Upper Cervical Chiropractic Research Association. All donations are tax deductible.

Donors to this fund include:

Dr. Andrew Mathias	Indiana
Mr. & Mrs. James Lowe	Ohio
Mr. Bert Kizer	Illinois
Mrs. Marynelle Shields	Indiana
Dr. Laurence Vinson	Alabama
Dr. M. Wayne Clark	Oklahoma
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