THE UPPER CERVICAL
MONOGRAPH

Volume 3. No. 2 December, 1981

A Reevaluation of the Lever System in Upper Cervical Adjusting

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NOVEMBER, 1981

Earlier it was reported the upper cervical units resemble a first or second class lever system (Seemann, 1978). It was proposed that the atlas is the rod that receives the effort. The skull acts as the resistance and the axis unit (C2-C7) is the fulcrum. (See Figure 1.) Using the classification system that Gregory (1981) has given to the three basic types of subluxation, each type represents a different lever system. For an example, the first basic type (formerly opposite to the kink) is a first class lever because the effort (E) comes down and around the axial circle. The superior articulating surfaces of axis acts as the fulcrum moving the lower cervicals back to the vertical axis line. The opposite articulating surface of atlas contacts the inferior surface of the occipital condyle moving the skull back to the vertical axis. The first basic type then is a first class lever because the effort (E) is located opposite to the resistance (R) with the fulcrum (F) in the middle. (See Figure 2.) The second basic type (formerly into the kink) is classified as a second class lever because the effort (E) goes up and around the condylar circle. The resistance (R) is first contacted at the superior articulating surface of the occipital condyles which moves the skull back to the vertical axis. The inferior surface of the opposite occipital condyle then contacts the atlas, the resistance (R), which moves the lower cervical unit back to the vertical axis. The second basic type is a second class lever because the effort (E) is located opposite to the fulcrum with the resistance in the middle. (See Figure 3.) The third basic type is also adjusted as a second class lever because the method of restoring the subluxation to the vertical axis is to apply the effort (E) up and around the condylar circle. Therefore, for the same reason that the second basic type is a first class lever the third basic type is classified similarly.

The center of gravity studies (Seemann, 1980 and 1981) caused a reevaluation of the lever systems. The skull placed on the headpiece has a low center of gravity because the long side of the skull is located on a relatively flat surface making the skull equilibri-

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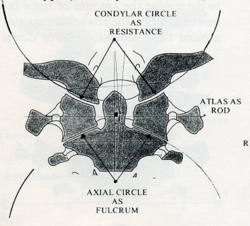

Fig. 1 Lever System
Upper Cervical Spine

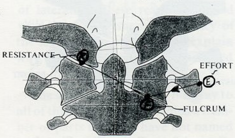

Fig. 2
First Basic Type - First Class Lever

The Cranial Center of Gravity

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Background

Virtually nothing is found in the biomedical literature concerning the location of the center of gravity (C.G.) of the skull. Most notable among these exceptions is the recent publication by Daniel Seemann (1980). Seemann cites the relevant literature and offers a theory as to the location of the C.G. based on a pilot study. This study is concerned with determining the center of gravity of the skull based on the methodology used in the Seemann study. Seemann suggested that further research was needed to verify his findings. He used two skulls of dissimilar shape but found the center of gravity of both skulls remarkably similar. The purpose of this study was to use a larger sample to verify the findings of the Seemann study.

Procedure

The opportunity to undertake this research became available through Robert T. Anderson, Ph.D., Director of Research, at Life Chiropractic College-West who is a Research Associate at the University of California, Berkeley. This provided access to the osteological laboratory of the Lowie Museum of Anthropology, with its large collection of skeletal specimens.

Forty-eight skulls were identified as possible sample specimens for this project. All were brachycephalic, but not all proved suitable for the study. Fifteen were finally selected for measurement. This extends in a statistically valid way, the skulls measured by See-

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A Reevaluation of the Lever System in Upper Cervical Adjusting

(Continued)

um quite stable. The skull weight is also 90° to the vertical axis line. The conclusion was the skull more accurately was the pivot for the lower cervical units and should be regarded as the fulcrum and not the resistance. The lower cervical units better satisfied the condition of the resistance because the C2-C7 unit move either toward or away from the vertical axis. Reversing the fulcrum and the resistance has important ramifications for the lever system. For an example, the first basic type, becomes a second class lever, because as the force moves down and around the axial circle the resistance (R) is found on the superior surface of axis on the same side as the effort (E). The fulcrum is located on the occipital condyle opposite side to the effort (E). (See Figure 4.) The first basic type is now a second class lever because the resistance (R) is located between the effort (E) and the fulcrum (F). The second and third basic types become first class levers because as the effort moves up and around the condylar circle the occipital condyle on the same side as the effort (E) acts as the fulcrum (F). The superior surface of axis opposite to the side of the effort then acts as the resistance (R). The second and third basic types then become first class levers because the fulcrum is located between the effort and the resistance. (See Figure 5.)

To give this reevaluation of the lever system a proper perspective, drawings of actual x-rays were made to illustrate the change in the system. Figure 6 illustrates the first basic type as the skull rests on the headpiece. Note the skull has tilted left toward the vertical axis line and the angular rotation line is to the right of vertical axis line. By drawing in the vertical axis line on the x-ray the adjuster can immediately determine what has to happen to the skull and lower cervical unit in the adjustment. Also note the high plane line of the atlas and the lateral shift of atlas. Again, the first basic type is a second class lever because the effort (E) is directed at the right transverse process which comes down and around the axial circle. Resistance (R) is encountered on the right side of the superior articulation of axis which, if properly adjusted, will move the lower cervical unit toward the vertical axis line. The fulcrum is located on the occipital condyle opposite to the side of laterality.

Notice also in Figure 6 the location of the center of gravity of the skull. It is necessary to determine the center of gravity of the skull in order that the skull is placed precisely on the headpiece to facilitate the adjustment going down and around the axial circle. With the first basic type, the center of gravity should be located as close to the edge of the headpiece as possible. This positioning will facilitate the skull pivoting in a downward clockwise motion as the effort meets the resistance. It is also helpful to position the lower cervical unit as horizontal as possible which also facilitates the clockwise motion.

Figure 7 shows the second basic type as the skull rests on the headpiece. Note with this type of subluxation, the skull has tilted toward the vertical axis but from the left side. The lower cervical unit has shifted to the left of the vertical axis line. Again the vertical axis line tells the adjuster what has to happen with the skull and the lower units. The plane line usually is horizontal and there will be less lateral shift of the atlas. The second basic type is a first class lever because as the effort (E) is directed up and around the condylar circle, with the fulcrum (F) located at the right occipital condyle and the resistance (R) is found at the left superior articulating surface of axis which pushes the lower cervical unit back to the vertical axis line. The third basic type is adjusted in the same manner. To add to the confusion which probably is already in the mind of the reader, the third basic type is a special case because no lower angle exists in the subluxation and the skull tilts from the vertical axis. The lower cervical units are the fulcrum and the skull is the resistance. This would make the third basic type a second class lever. The incidence of the third basic type is small and only occurs in about 10% of the subluxations.

In placing the skull on the headpiece with the second and third basic type the center of gravity of the skull should be placed further superior from inferior edge of the headpiece on the down side of the mastoid support. This positioning will facilitate the skull pivoting in an upward counter clockwise motion when the effort is directed toward the right transverse process. It is also helpful to position the lower cervical units as close to the horizontal plane as possible to facilitate the rotatory movement of the counter clockwise motion.

Force and Displacement

With the lever system, it is possible to determine the amount of force required to move the atlas either up and around the condylar circle or down

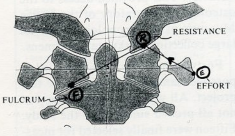

Fig. 3
Second Basic Type - Second Class Lever
Third Basic Type - Second Class Lever

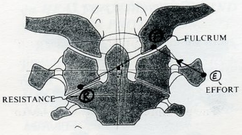

Fig. 4
Second Basic Type - First Class Lever
Third Basic Type - First Class Lever

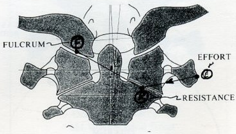

Fig. 5
First Basic Type - Second Class Lever

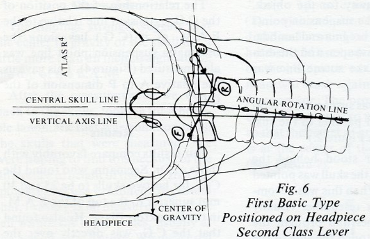

Fig. 6
First Basic Type
Positioned on Headpiece
Second Class Lever

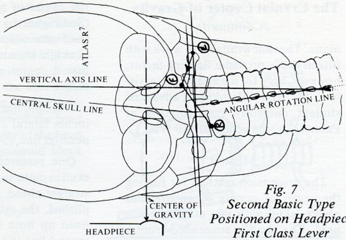

Fig. 7
Second Basic Type
Positioned on Headpiece
First Class Lever

and around the axial circle. The formula from physics for levers is: the counter clockwise component must equal the clockwise component, i.e., the distance from the fulcrum x the resistance must equal the distance from the fulcrum x effort (Miller, 1977). With the first class lever, assuming the rod is a distance of one, the length of the distance between (R) and (F) can be set arbitrarily at 2/3 and the distance between (F) and (E) at 1/3. The theoretical amount of effort required to move the resistance then can be calculated. (See Figure 8.) For a first class lever the effort required to move the resistance would be 2R. The second class lever requires less effort to move the resistance, again refer to Figure 8,

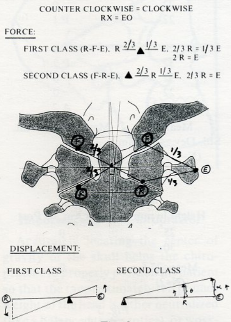

Fig. 8
Force and Displacement

the effort required to move the resistance is 2/3 R.

Understanding the dynamics of force and displacement will help in the adjustment. For an example, the first class lever while requiring more effort to move the resistance will displace the resistance a greater distance. This is why the second basic type is considered easier to adjust. Once the movement around the condylar circle is started, the long resistance arm of the lever pushes the lower cervical units back to the vertical axis with a minimal number of adjustments. (See Figure 8.) On the other hand, the displacement of the second class lever is not as efficient as the first class lever but requires less effort. More displacement is required at (E) to move the resistance. (See Figure 8.) This explains in part, why more adjustments are required to bring the resistance (lower cervical unit) back to the vertical axis.

Other reasons why the first basic type is more difficult to adjust are: (1) the axial circle is generally larger than the condylar circle, therefore a larger component to move, (2) there is usually more of a lateral displacement of axis, and (3) the plane line is high on the side of laterality. These reasons coupled with the displacement inefficiency of the second class lever helps to explain why the first basic type is considered more difficult to adjust.

The unimpressed reader may say to all of this, "So you have named a number of parts that you have not named before and you have completely reversed your earlier thinking that the skull is now considered the fulcrum and the lower cervical unit is considered the resistance. Does this really change anything?" The standardization of the biomechanics of the adjustment using levers has greatly improved the efficiency of the adjustment. Being able to visualize the relationship between the skull, the lower cervicals and the atlas has furthered the knowledge of the dynamics of the upper cervical area. As a consequence, it is easier to reduce the subluxation and it is easier to teach how to reduce the subluxation. It is sincerely hoped that sharing this information will be of some help to you.

Daniel C. Seemann
November 10, 1981

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The Cranial Center of Gravity

(Continued)

mann. The time available to work with fifteen skulls proved a limiting factor, however, both for me and for my assistant, Ms. Mary Mishkit, an advanced student currently matriculating at Palmer Chiropractic College-West.

Method

The suspension method for finding the center of gravity of an irregular object (skull with jaw attached) was used. The skull is suspended from a line. The skull comes to rest with the center of gravity directly under its suspension point. By extending the vertical line, formed by the string, a line of gravity is formed.

The center of gravity is somewhere along this line. Suspending the object from different points and measuring where the intersection of these lines take place gives the exact location of the center of gravity for the object. (See Figure 1.) The suspension points used were nasion, bregma and lambda. (2 skulls were misshapen and the estimated center of the suture line was used.)

A second line was suspended several inches lateral and parallel to the suspension line. (See Figure 2.)

One researcher stood behind the skull to make sure the skull was pointed straight ahead. When this was accomplished, the other researcher visually lined up both lines and brought the second line in to touch the side of the skull. A pencil line was drawn on the skull using the second line as a guide (Figure 3), this is the extension of the vertical line.

After suspending the skull from all 3 points, the height of the C.G. found was measured from the top of the external auditory meatus (E.A.M.) 90° to the frankfort plane (Figure 4).

The relationship of the position of the C.G. extension line relative to the E.A.M. as it (C.G.) lies along the bregmatic suspension point line was also measured (Figure 4). This gave us the relative A to P dimension of the C.G.

Results

Our results compare favorably with those of Dr. Seemann, who found the C.G. for his two skulls to be 25 and 30 mm superior to the top of the E.A.M. in the Frankfort Plane. He also found that the C.G. was directly over the auditory meatus when the skull was in balance.

Our data showed that the mean height for the skull C.G. was 26mm above the top of the E.A.M., with a standard deviation (N-1) of 4.720mm. We also found that the average C.G. to be .33mm anterior to the middle of the E.A.M., virtually directly over it. (See Figure 5.)

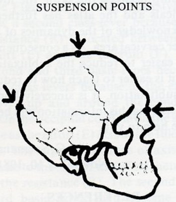

Fig. 1

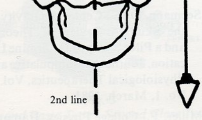

Fig. 2

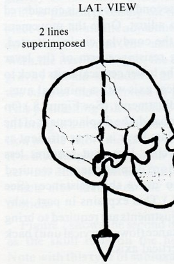

Fig. 3

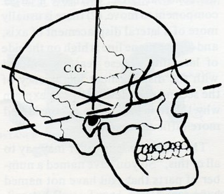

Fig. 4

Life Chiropractic College-West Data

Height in mm	mm Ant. or Post
26	0
22	A 3
27	A 3
30	A 2
29	A 1
35	A 1
32	A 2
27	P 5
22	0
22	P 1
20	0
32	P 2
22	0
22	0
22	A 2
Mean=26	Mean=.33mm Ant.
Std. Dev.=4.720mm (N–1, N=15)	

Seemann Data

Height in mm	mm Ant. or Post
25	0
30	0
Mean=27.5 (N=2)	0

Fig. 5
Comparison of Findings Between LCCW and Seemann Data.

Discussion

The findings strongly suggest that the center of gravity of the skull lies a little more than an inch straight above the top of the E.A.M.

After the measurements, we went back to the skulls, looking for a possible landmark that was common to all the skulls that were measured. We were hoping to find this because of the difference in height of the C.G. that the individual skulls exhibited. We found that, in every skull measured, the C.G. fell within the nasal bones, usually at the Nasofrontal Suture. We measured the skulls in a simulated adjustment position. That is to say, the skulls were laid flat on a table, facing perpendicular to the edge of the table, just as an adjustor would position the patient. We lined up a triangle to the edge of the table and ran the flat edge through the previously marked center of gravity. (See Figure 6.) Finally, we looked along this flat edge, and came up with the previously mentioned findings.

The top of the nasal bone is a convenient landmark for the practitioner to locate on the patient. (The patient should be properly positioned however.)

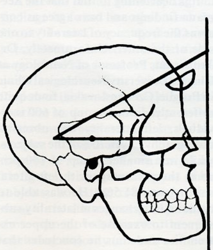

Fig. 6

Importance to the Chiropractor

Accurately locating the center of gravity of the skull helps the chiropractor to properly position his patient so that the (approximately ten pound) weight of the head is either neutralized (like a balanced teeter totter), or working for the adjustor.

In an opposite angles subluxation (Type 1) the adjustor's force is directed down and around the axial circle. The head should not be positioned high up on the headpiece, or the weight of the head will work against the adjustor's force vector. The proper way to position the patient is to position the head so that the center of gravity of the head is at the center of the mastoid block (See Figure 7).

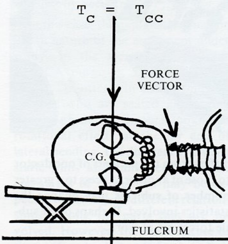

Fig. 7
Adjustment of the First Basic Type

Another way to accomplish this is to position the patient's skull so that the bottom of the headpiece is between the bottom of the mastoid and the center of the patient's eye sockets.

One must not let the head be positioned at an improper height or angle. Make sure that the patient's head, chin and episternal notch all form a straight (parallel) line. Also, when the head is positioned in this manner, an excessive adjustive force could prove injurious to the patient by putting the patient's neck into a kink. Be careful!

An additional point which will help ensure that the weight of the patient's head will not work against the adjustic force is to angle the top of the headpiece slightly ceilingward so that the parietals are supported by it. (See Figure 7.)

When dealing with an into the kink (type 2) subluxation, the top of the headpiece should be angled towards the floor, and the C.G. is positioned above the center of the mastoid block.

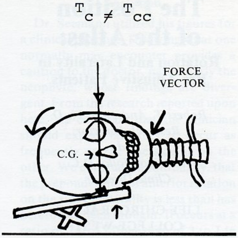

Fig. 8
Adjustment of the Second Basic Type

(See Figure 8.) (The bottom of the mastoid will be up on the mastoid block.)

Summary

We at Life Chiropractic College-West are actively pursuing research relevant to the needs of Upper Cervical Chiropractic. This article dealt with the center of gravity of the skull, and is a replication and enlargement of the study initiated by Drs. Seemann and Gregory. In it, we present more statistically valid data (because of the larger sample size) regarding the skull C.G., which compares favorably with Seemann's earlier work.

We have also shown how an Upper Cervical practitioner may utilize this vital piece of information to help him to achieve his objective of easy, maximal subluxation reduction.

Footnote

This investigation was carried out under the auspices of the Department of Research, Life Chiropractic College-West, Dr. Robert T. Anderson, Director. The osteological collection was made available courtesy of Dr. Frank A. Norick, Principal Museum Anthropologist, Lowie Museum, University of California, Berkley.

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The Position of the Atlas:

Rotation and Laterality in Pre-Adjustive Patients

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LIFE CHIROPRACTIC COLLEGE-WEST

Introduction

In July, 1979, Dr. Ralph R. Gregory offered the first NUCCA seminar ever presented on the West Coast. It took place in California at what is now Life Chiropractic College-West. During an intense five days, a comprehensive overview of the NUCCA approach to upper-cervical chiropractic care was offered. One incidental set of comments, taking only a moment of time, provided the stimulus for some research and analysis that is reported upon in what follows.

During a question and answer period, Dr. Daniel C. Seemann offered the following comments helpful to the busy practitioner. Referring to unpublished studies carried out by NUCCRA, he observed that they found on initial x-rays that 75% showed anterior rotation, and 25% posterior rotation on the side of lateral flexion. Based upon that study, Dr. Seemann made the following clinical suggestion. "If you get more posteriors, you may be going wrong in analysis." The question was then raised by a member of the audience as to whether one was more likely to encounter a right or a left laterality. To that Dr. Seemann replied, "About the same. One to one."[1]

An essential and often costly part of scientific inquiry consists of work that is mere replication. One scientist repeats the experiments of his colleague in another institution. In doing so, greater precision is attained. This is especially so, since with a number of repetitions one is able to eliminate distortions that otherwise may not be apparent. It is possible, for example, that the nature of rotation and laterality

differs from the patients of one doctor to those of another. Access to a greater number of subjects may change the statistics involved. Perhaps other subtle forces are at work.

One recent study eminating from the Research Department of Life West offered a replication of Dr. Seemann's study of the location of the center of gravity in the human skull.[2] In what follows, we report upon our replication of Dr. Seemann's findings concerning rotation and laterality.

Method

In a recent editorial, George W. Northup, D.O., points out that the office files of busy practitioners can serve as rich data banks for research.[3] The present study was conceived with precisely that potentiality in mind. Our purpose was to look at a large number of radiographs that had been analyzed according to NUCCA procedures. George E. Anderson, D.C., made this possible by giving complete and unencumbered access to his files covering many years as a NUCCA practitioner. Beginning with the letter A and proceeding until the time of the investigators would permit no more, initial listings were recorded for a total of 808 new patients.

Results

Our findings concerning side of laterality agree substantially with the commentary of Dr. Seemann (Figure 1). A ratio of 46% to 53% is quite close to the one-to-one ratio found in NUCCRA research.

Left laterality	46%
Right laterality	53%
Neutral laterality	1%
N = 808 patients	

Figure 1
Lateral Flexion Listings

Our findings as concerns direction of rotation agree in a broad way with those of Dr. Seemann. We did find, however, that the tendency for anterior rotation was much less pronounced than in the NUCCRA work (Figure 2).

Anterior on side of laterality	55%
Posterior on side of laterality	38%
Neutral on one dimension or both	7%
N = 808 patients	

Figure 2
Rotation Listings

Discussion

It is heartening to find that the Seemann findings and ours agree as concerns the frequency of laterality to one side or the other. Unfortunately, Dr. Jan Jirout, Professor of Neurology at Charles University Neurological Clinic in Prague, Czechoslovakia, finds quite differently. In one group of 600 individuals, left laterality was observed radiographically in 70% of the subjects, while in a smaller group of 100 persons, the percentage with left lateral shifting was 81.5%.[4] He was able to demonstrate changes in laterality subsequent to exercise of the upper extremities and thus he concludes that right handedness, and the dominance of the left cerebral hemisphere is implicated.[5] Since handedness correlates with many assymetries in the musculoskeletal system, one must acknowledge the reasonableness of the Jirout findings and conclusions.[6]

It is difficult to resolve this difference between Jirout, on the one hand, and the NUCCA film findings on the other. Additional study is clearly indicated. We would recommend a restudy of NUCCA films, utilizing the radiographs of a number of experienced NUCCA practitioners. Provisionally, however, for the purposes of NUCCA analysis one may assume that the ratio of right to left laterality is approximately one to one.

Turning now to the issue of direction of rotation, we find it difficult to interpret the significance of a difference in findings which contrasts 55% anteriors (a ratio of 7 to 5) in our study against 75% anteriors (a ratio of 3 to 1) in the Seemann study. We are inclined to attribute greater correctness to our figures on two grounds. First, and perhaps most importantly, Dr. Seemann was reporting informally in the context of a seminar. It is possible that when more careful publishing is done, his findings will correspond more closely to our own. It may be that we report upon a much larger sample, and that his findings, although accurate, are distorted by a Type I statistical error, that is, a distortion due to the smallness of the sample. This is a common source of skew in statistical work, and is precisely one reason why replication can be a productive scientific enterprise.

A second reason for accepting our findings is found in other work by Jirout.[7] In an x-ray study of 322 subjects, Jirout examined rotational movement of the head and the atlas subsequent to unforced or forced lateral flexion of the head and neck. In order to utilize his data for the interpretation of movement between the atlas and the occiput, it was necessary to submit them to re-analysis. From reworking his figures, it appears that most of his subjects showed no rotational movement at the atlanto-occipital joint. Of those who moved, however, the overwhelming majority (at a ratio of more than 8 to 1), demonstrated posterior rather than anterior rotation on the side of laterality (Figure 3).

No movement	228
Anterior movement	10
Posterior movement	84
N = 322	

Figure 3
Rotation at the Atlanto-Occipital Joint based upon re-analysis 4.

The findings of Jirout seem to support the validity of our findings insofar as he, too, identifies posterior rotation as a frequent phenomenon. Unexplained, of course, is why he found far more of a preponderance of posterior rotation than did we, since he finds posterior rotation to occur at a ratio of more than 8 to 1, leaving anteriors as only a small minority. Once again, the Jirout findings appear to contradict findings based upon NUCCA films, whether by Seemann or by us.

In this case, the explanation may lie in the nature of the movement under study. In the x-rays analyzed for NUCCA purposes, we look only at relative positions in static films of patients who are seated and facing straight ahead. Dr. Jirout is looking at rotational effects at the far end of lateral bending. The difference between static films and films recording the end-stages of movement may be expected to show quite different relationships among the parts that are involved. However, the exact nature of that difference demands further clarification.

Although we can adduce two reasons for having confidence in our finding that posterior rotation is more common than hitherto thought, a position consistent with that of Seemann and very contrary to that of Jirout as well as of ourselves can be argued from anatomical consideration.

According to I. A. Kapandji, in rotation at the atlanto-occipital articulation, the *obliquus capitus superior* produces as much as 10° of rotation of the atlas on the side opposite that of lateral flexion.[8] This has the effect of producing anterior rotation on the side of laterality, which is exactly what Seemann contends is most common. Since this introduces a hypothetical rather than a demonstrated contradiction of our findings, and especially since one cannot predict movement of this magnitude on the basis of findings relating to a single muscle when the synergism of many is involved, one can only conclude, again, that further research will be necessary to bring finality to this issue. In the meantime, our findings appear to stand as the best current statement on this issue as concerns NUCCA radiographic analysis.

Conclusion

Dr. Seemann utilized his figures for a clinical purpose. Knowing what one normally may encounter provides a caution to the doctor, particularly the neophyte, whose findings are divergent. From the research reported upon here, we conclude that the clinician should expect laterality to occur as frequently on the one side as on the other. We conclude, additionally, that the preponderance of anterior rotation on the side of laterality is less than has heretofore been thought. It occurs at a ratio of 7 to 5 rather than of 3 to 1 in films taken according to the NUCCA protocol.

Above all, however, this study points up to the need for a large-scale restudy of the whole issue of the position of the atlas as concerns rotation and laterality in pre-adjustive patients.

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The 1982 NUCCA Convention

On May 15, 16, 17, and 18, 1982, the National Upper Cervical Chiropractic Association, Inc. (NUCCA) will hold its Sixteenth Annual Convention and Seminar at the Howard Johnson Motel, 1440 North Dixie Highway, Monroe, Michigan 48161.

The theme of the convention, Biomechanics of the Spinal Column, underlies the purpose of the seminar and is based on the research work conducted by the National Upper Cervical Chiropractic Research Association, Inc. (NUCCRA) during the past year. This research is highly practical, and designed to benefit the practitioner in his daily practice.

A joint paper, *Radiographic-Anatometer Correlations in Full-Spine Patient Analysis,* based on the research conducted by Robert T. Anderson, Ph.D., research director of Life Chiropractic College-West and Amerigo J. Biollo, M.E., D.C., will be presented.

A basic film analysis course will be available for those not previously having had the basic work. This course will be presented separate from the convention. Advanced film analysis, however, will be taught at the convention.

Video tapings will be made as part of the adjusting technique for those who wish to see themselves adjusting. In the fall seminar these tapes proved invaluable to participants in developing the technique of adjusting.

The NUCCA Seminar is designed for license-renewal.

Additional information can be obtained by writing NUCCA, 217 West Second Street, Monroe, Michigan 48161.

UNIVERSITY OF TOLEDO SPONSORS NUCCRA LICENSE-RENEWAL PROGRAM

The Ohio State Chiropractic Association (OSCA) held its 1981 annual meeting at the Hyatt-Regency Hotel in Columbus, Ohio, November 6, 7, and 8. The National Upper Cervical Chiropractic Research Association (NUCCRA) conducted the Educational Seminar for License-Renewal under the sponsorship of the University of Toledo. Dr. Daniel C. Seemann was in charge of the NUCCRA Program.

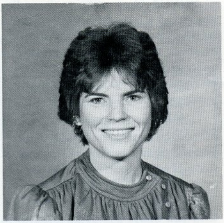
The theme of the seminar was measurement of the upper cervical spinal column, biomechanics, and neurology of the atlas subluxation complex.

Speakers from the University of Toledo were: Daniel C. Seemann, Ph.D., NUCCRA research director. Dr. Seemann discussed *RESEARCH AND TRAINING PROBLEMS IN CHIROPRACTIC,* and a *REVIEW OF RECENT UPPER CERVICAL (NUCCRA) RESEARCH.* Donald Stolberg, Ph.D., lectured on *BIOMECHANICS OF THE HUMAN BODY.*

David M. Drury, B.A., Bowling Green University, presented a paper on HEALTH CARE ETHICS AND CONSUMER PROTECTION.

Ralph R. Gregory, D.C., NUCCRA president, reviewed *UPPER CERVICAL BIOMECHANICS, MEASUREMENT PROCEDURES,* and *NEUROLOGY OF THE C1 SUBLUXATION.*

A certificate of attendance from the University of Toledo will be issued to each doctor attending the seminar.



Dr. Simone I. Schroder announces her association in practice with Dr. Robert Brooks in his office in Tahlequah, Oklahoma.

A native of Davenport, Iowa, Dr. Schroder attended Marycrest College there, graduating in 1969 with a degree in Natural Science. She taught junior high science in Davenport following her graduation.

In 1978, Dr. Schroder enrolled in Palmer College of Chiropractic, where she was active in class activities, the Upper Cervical Society, and the NUCCA Club. During her externship at the Palmer Clinic, Dr. Schroder attended NUCCA Educational Seminars. She graduated from Palmer in March, 1981, Magna Cum Laude.

Dr. Schroder received her Oklahoma State License in 1981, and also holds licenses in Michigan and Iowa, and is a Diplomate of the National Board of Chiropractic Examiners. Dr. Schroder is planning to make Tahlequah her permanent home.

The Upper Cervical
MONOGRAPH
Published by
THE NATIONAL UPPER CERVICAL CHIROPRACTIC ASSOCIATION, INC.

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Monroe, Michigan 48161