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An Evaluation Of The Objectivity and Reliability Of The Anatometer

By Daniel C. Seemann, Ph.D.

Abstract

The reliability and objectivity of five observers using the Anatometer was computed. High coefficients were found for reliability but mid range coefficients were obtained for objectivity. Factors influencing consistency such as the observer, the subjects and the instrument were discussed.

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In recent months the Anatometer has been mentioned in two different articles. The first was a study directed by Addington(2) at Texas CC which was concerned with the reliability and objectivity of the Anatometer and some other chiropractic procedures. The second, was an article by Anderson(1) comparing the Gravity Stress Analyzer with the Anatometer and how they both seemed to have low consistency in measuring body posture yet still had value for scientific inquiry.

As the principal investigator of the Anatometer over the past ten years the writer was heartened to see some interest taken in evaluating the Anatometer by someone outside the NUCCA family. As Anderson(1) notes "... chiropractic has been extraordinarily neglectful ..." with regard to testing instruments under laboratory conditions.

The low coefficients found by Addington with regard to the frontal plane, transverse plane and the fixed point measurements were somewhat surprising because in practice, these measurements are quite consistent. Addington notes "... the low correlations may have been due primarily to intrusiveness of the procedure ..." and the writer concurs. In the Addington study there were 11 different measurements or evaluations taken of each subject with two rotations per day over a two day period. Of the 11 procedures six involved some form of palpation and several of the subjects reported audible releases during the process.

Subject variability must be kept to a minimum, because if subject variability is not controlled the investigator cannot be sure the consistency or lack of consistency is due to the observer or the subject. The purpose of this study was to measure the reliability and objectivity of several observers using only the Anatometer as the focus of the investigation. Validity was not considered in this study because that phase of evaluating the Anatometer was addressed by Seemann in 1976.

METHOD

Subjects

The subjects were all volunteers and chiropractic practitioners from various parts of the country who were attending a NUCCA seminar. The age range was 24-62 with the mean age in the

(Continued on page 2)

Errors In The Performance Of The C1 Motor Skill

By Ralph R. Gregory, D.C.

Introduction

Failure to maximally reduce or to correct the misalignment factors of the C1 subluxation complex usually stems from errors in the adjuster's performance of the motor skill. The misalignment factors of a given C1 subluxation predetermine the exact direction in which the adjustic force must be applied, and their reduction or correction requires considerable skill and the ability to recognize and avoid adjustic errors. This paper examines some of the major errors and discusses remedies. These remedies have been tested by post x-raying cases immediately after the adjustment.

Because of the growing criticism of the procedure of post x-ray, some comments should be made here in its defense. Post x-rays of a case, when analyzed and compared with the original x-rays, show clearly the degree of reduction of the C1 misalignment factors. This is felt by most upper cervical adjusters to justify the posting procedure because it protects the patient against inefficient adjusting. Furthermore, it provides the adjuster with a system of monitoring his patient's response in relation to the reductions obtained by the adjustment.

Over the past 40 years, the taking of post x-rays has aided immeasurably in the development of improved systems of adjusting. Greater accuracy and control of the adjustic forces have resulted from comparative studies of pre and post x-rays. Development of these improved systems has been in the best interests of the patient because the

(Continued on page 4)

An Evaluation of the Anatometer

(Continued from page 1)

upper 20's. Two females and eight males were measured. All the participants had been under some form of chiropractic treatment and were known to be out of adjustment and therefore would register some form of pelvic distortion in the frontal or transverse planes. The chiropractic history of each participant was not known to the observers.

Observers

The observers were picked on the basis that they had previous experience using the Anatometer, although the level of competence was not known prior to the study. Each of the five observers were assigned a recorder (another chiropractor) who registered the measurements verbally transmitted to the observer.

Instrument

Two Anatometers were used for the measurement. Each machine was balanced and set before the study and the arms of the Anatometer were checked for free movement. A person known to be in adjustment was checked on each instrument and the same readings were recorded thereby assuring the consistency of the two instruments.

Procedure

Each subject was measured twice by each observer during the two day period. A total of 50 measurements were taken each day. In order to balance out the effects of the two Anatometers, each subject was measured five times on each Anatometer each day. The observers also were required to use both Anatometers during the two day period.

The subjects were told to wear loose fitting clothing and were allowed to wear shoes, but were required to wear the same shoes both testing days.

The observers were blind as to the previous day's measurements. The only information that was given the observer was the side of the short leg as determined by the supine leg check. The observers were told the side of the short leg because it is possible to have either a high or low reading in the frontal plane. It is possible to record a high right frontal plane as a low left frontal plane. If this occurs the transverse plane could be posted incorrectly as for an example anterior could become a posterior. These relationships need to be accurate because the clinician must know whether the pelvic distortion is "in pattern" of "out of pattern". "Out of pattern" relationships suggests or clues the adjuster to look for something different in the analysis before the adjustment.

The Pearson r was used in analyzing the data. A scatter plot indicated reasonable linearity and the actual running of the data indicated the Pearson was extremely sensitive to slight variations in measurement by the observers. With an N=10 though, an r=.55 was required for significance at the .05 level.

The prediction as to the direction of the data was positive and high. Therefore a one-tailed test of significance was used with an error at the .05 level.

RESULTS

Table 1 shows the mean reliability coefficients for the frontal plane, transverse plane and the fixed point for the five observers for both days. The standard deviations and range are also given. These figures represent the consistency of the observer between the first and the second day. The frontal plane and the fixed point were found to be significant.

Table 1. Observer Reliability for the Frontal Plane, Transverse Plane, and Fixed Point. Five Observers Both Days.

	Xr	SD	RANGE r's
Frontal	.81**	.72	.05–.98
Trans.	.44	.44	–.02–.83
Fixed Pt.	.63*	.06	.57–.68

* p .05 r= .55
**p .01 r= .72

Table 2 shows the objectivity of the frontal plane, transverse plane and the fixed point for two observers who measure patients at the same local. Both have similar backgrounds with regard to procedure and training and clinically have experienced a high consistency in measuring patients. With all three measurements, the coefficients were significant. The average error in degrees is also given.

Table 2. Observer Objectivity for the Frontal Plane, Transverse Plane and the Fixed Point. Two observers- 1st Day.

	Xr	X error
Frontal	.80**	.5 degrees
Trans.	.72**	1.28 degrees
Fixed Pt.	.68*	.68 degrees

* p .05 r= .55
**p .01 r= .72

Table 3 shows the mean objectivity coefficients for the frontal plane, transverse plane, and the fixed point for the observers for the first day. The standard deviation and range of coefficients are also given.

Table 3. Observer Objectivity for the Frontal Plane, Transverse Plane and the Fixed Point. Five Observers- 1st Day.

	Xr	SD	RANGE r's
Frontal	.35	.46	–.02–.80
Trans.	.34	.55	–.44-.72
Fixed Pt.	.55*	.33	.13–.70

* p .05 r= .55
**p .01 r= .72

Table 4 shows the mean objectivity coefficient for the frontal plane, transverse plane and the fixed point for the five observers for the second day. The standard deviations and the range of coefficients are also given. Only the fixed point measurement is significant.

Table 4. Observer Objectivity for the Frontal Plane, Transverse Plane and Fixed Point. Five Observers- 2nd Day.

	Xr	SD	RANGE r's
Frontal	.38	.33	–.05–.65
Trans.	.48	.34	.14-.74
Fixed Pt.	.81**	.35	.67–.92

* p .05 r= .55
**p .01 r= .72

DISCUSSION

A comparison of the results of this study with the Addington study shows the following. Addington found reliability coeffients of .08 and .21 for the frontal plane. This study found a reliability of .81. Addington found reliability coefficients of .54 and .23 for the transverse plane. This study found .44. Addington found reliability coefficients of .49 and .62 for the fixed point and this study .63. There is a marked increase in the frontal plane coefficient but similar indexes are found with the transverse plane and fixed point.

With objectivity, Addington found a coefficient of -.08 for the frontal plane and this study found coefficients of .35 and .38. Addington found a coefficient of .15 for the transverse plane and this study found coefficients of .34 and .48. Addington found a coefficient of .36 for the fixed point and this study found coefficients of .55 and .81. Although the indexes are generally higher in this study they are not significant. Addington found the fixed point index significant and it was true in this study. There are probably several factors operating which have influenced these results.

Addington's concern that multiple measurements on the subjects may have been too invasive may have been right on target. A patient who is either sensitive or sore in the illium area can be difficult to measure. Each of his subjects were given 44 measurements during the two day period. With the Anatometer, the most crucial procedure is to accurately place the calipers of the Anatometer on the crests of the illium. His findings show results not much better than chance either with reliability or objectivity. The placement of the calipers could have been very tedious after so many measurements.

The transverse plane and the fixed point measurements are relatively independent of the frontal plane and that might explain the higher coefficients found with both reliability and objectivity. The transverse plane rotates around the vertical axis and the fixed point from the vertical axis. This is shown more clearly in the Addington study where the transverse plane and the fixed point coefficients are higher than the frontal plane. This means that it is possible to inaccurately place the calipers on the hips and still obtain accurate transverse plane and fixed point measurement.

Addington mentioned that subjects generally were measured with their shoes on. It is probably better to have the subjects either be measured with shoes on or off. If the subjects do wear shoes they should be inspected for run-down heels or lifts. It is also important they wear the same shoes for all measurements.

Probably one of the single biggest sources of error is the subject. And probably the worst group to measure are chiropractors or chiropractic students. They tend to be quite unstable biomechanically, especially if they are adjusted often. In the present study, one of the subjects changed the side of the short leg from the 1st day to the 2nd. If the observers were not aware of the change from the first day to the second, the reliability coefficients would not be consistent and therefore lower the coefficient.

Another factor that influences subject variability is fatigue which especially influences the transverse plane measurements. This notion is supported in Table 1 which shows the transverse plane coefficient to be the lowest of the three indexes. This is predictable because in practice this measurement is the most variable. A variance of two degrees is not considered enough to adjust the patient. It has been noted at seminars for example, where people come from long distances and are monitored over the course of the seminar their transverse plane readings will lower with rest if they are in adjustment.

The consistency of the observer is of course what the study is about, and the most crucial procedure for the observer is to accurately place the calipers on the crest of the illium. This is the most crucial measurement because the decision to adjust the patient rests with this measurement. Therefore a high consistency is necessary. With five observers, an r= .81 is considered high but it also represents about a .5 degree discrepancy and this would be the minimum allowable variance. In these types of studies the difference in level of training can influence the outcome and it is the opinion of this writer there is probably a lack of proper training and preparation accompanying the Anatometer as it goes out in the field. The level of the observers should be ascertained prior to launching any new studies about reliability and objectivity on any new instrument in chiropractic.

The instrument should not be forgotten as a possible source of variability. The Anatometer should be absolutely level and checked before, during and after an investigation. All the planes of the instrument should move freely around the vertical axis. It also has been noted that when the barometer is dropping, measurements can be more variable but it is not certain if this variability come from the patient or the Anatometer. And finally the motor driven pedals should be checked frequently especially if the pedals are raised to balance the patient. It is not uncommon to forget to balance the pedals and this will alter the measurements taken from the patient.

In conclusion, this study has attempted to show that a rather high reliability can be realized using the Anatometer, but objectivity although consistent generally was not within the NUCCA standards. Sources of variability were discussed which include the observer, subject and the instrument.

December, 1983

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[3]Seemann, D.C., C1 subluxations, short leg, and pelvic distortions. The Upper Cervical Monograph, Vol. 2, No. 5, Nov. 1978.

Errors of the C1 Motor Skill

(Continued from page 1)

degree of correction of the subluxation's misalignment factors has been found statistically to relate closely to patient response. In a 1976 study, Seemann[1] found that a patient's favorable prognosis is best when the subluxation's misalignments are reduced by 80 percent or better. The better the reduction, the better the patient response.

Comparisons between the original x-rays and the post x-rays, furthermore, establish a data base from which comparisons can be made between the amount of the correction of the C1 subluxation's misalignments and its distortion effects on the spine and pelvis. How can the beneficial effects on the human body of adjusting vertebral subluxations be validly measured until the subluxation's misalignment factors can be proved to be reduced or corrected? Post x-rays can be seen, measured, and compared with pre x-rays. What the comparison discloses is objective and factual.

If post x-ray is a valid means for proving that the patient has been biomechanically improved and that subluxation reduction is necessary to favorable patient response, why does the procedure meet with opposition in the profession? Post leg-check and thermographic posting have not proved reliable methods for ascertaining subluxation correction immediately after an adjustment. A major reason may be that the C1 subluxation has been oversimplified; its problems and complexities unrecognized and unresolved. Any force applied along any direction appears to be the attitude of too many practitioners, even though the relevant laws of mechanics are thereby violated. If these mechanical laws were properly applied, chiropractic would become more scientifically acceptable.

Another reason may be that too few adjusters are sufficiently skilled in correcting C1 subluxations. They lack the training, are not taught how to apply relevant mechanical and kinesiological principles in the art of adjusting a C1 subluxation. The mechanically inept methods that they are taught, and which they practice, may suffice for adjusting subjacent misaligned vertebrae with their built-in reduction pathways but prove inadequate in the upper cervical spine where the articulations are not shaped to guide the vertebrae to normal position from an improperly applied force.

This lack of training is difficult to understand when the subluxated C1 vertebra is the most detrimental in the human spinal column because it affects the central nervous system, distorts the spine and pelvis, and modifies neurological transmission through the spinal cord by causing reduction of the inhibitory control over spinal cord nerve flow located in the caudal end of the brain stem.

Discussion

Two very common errors that occur in adjusting the C1 subluxation are the excessive use of force and depth. Force and depth are too frequently relied upon instead of skill to move the misaligned vertebrae that comprise the C1 subluxation complex. What makes these two elements ineffective and dangerous is that their use in the adjustment upsets the positional relationship with contiguous osseous structures which the adjuster is attempting to obtain. Force is dangerous when its magnitude is greater than the resistance offered by the C1 subluxation, which varies in different type cases.

An adjustic force applied to a C1 vertebra is transferred to the superior articulating surfaces of C2 which is the base of support for C1 and the skull or load. When adjusting upper cervical vertebrae, the articulation between C1 and C2 constitutes the weakest point in the cervical spine. C1 moves laterally about the occipital condyles as the result of adjustic force only when C1 is moved either down and around the superior articulating surfaces of C2 (type 1) or up and around the superior articulating surfaces of C2 (type 2 & 3). If the adjustic force is too great, C2 may be moved excessively and C1 may not move laterally in relation to the occipital condyles, may misalign to a greater extent, or be carried through to the opposite side of the occipital condyles, causing future subluxation problems. The too forceful an adjustment may be compared to the sudden and uncontrolled movement of an object when the base on which it stands has been violently moved from under it.

Additionally, excessive force in the adjustic motor skill creates the depth error. Depth does not reduce or correct C1 subluxation-misalignments, but tends to create them or otherwise change the subluxation's characteristics. When a new subluxation is created as a result of too great a depth, the next adjustment will be, of course, inaccurate because the misalignments have changed and new force vectors would be required to insure reduction or correction.

A common example is seen when the excessive force and depth kinks the cervical spine between C1 and C2, causing the skull to tilt from the vertical axis toward the side of the C1 subluxation and changing a type 1 subluxation to a type 2 or type 3. Disequilibrium of the cervical spine, larger misalignments of cervical spine vertebrae, and, consequently, increased subluxations can and do occur from too great a force and depth.

Force also possesses direction as well as size. Because force possesses direction, it must be controlled and aimed. The direction in which the C1 adjustic force must be aimed is predetermined by establishing a resultant of the vectors computed from the x-ray analysis. This is the reduction pathway along which the adjustic force must travel (Fig. 1). Error of direction occurs when the adjustic force is delivered in a random fashion, in a manner contrary to the direction prescribed by the reduction pathway. Resultantly, the subluxation's misalignments are increased. A force that is delivered in a random fashion will not be corrected or guided by the articulations of the upper cervical spine. No built-in pathway (osseous) exists in the occipital-atlanto-axial spine that will direct a random adjustic force so that it will reposition upper cervical vertebrae. In subjacent spinal areas, the articulations are such that they help re-align vertebral segments when the adjustic force is not too accurately applied. A C1 vertebra adjusted in a haphazard

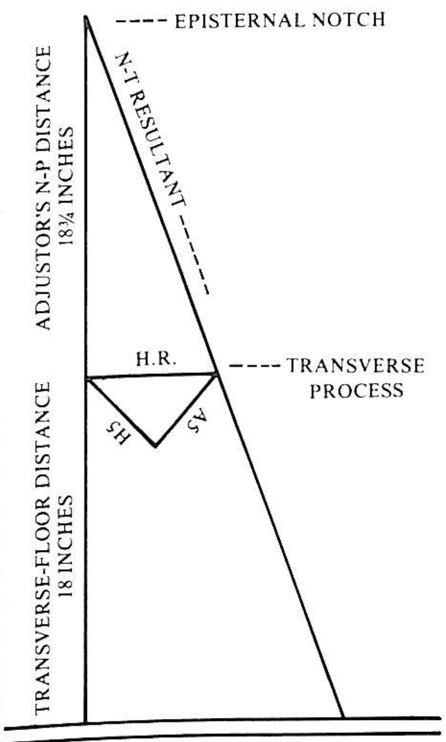


FIGURE 1

The reduction pathway (N-T Resultant) computed from x-rays and the adjuster's episternal notch to transverse distance for a C-1 subluxation requiring vertical and horizontal vectors of 5 inches.

and mechanically inept manner will show on the post x-ray either no correction or an increase in its misalignments. Increased misalignments ultimately create larger subluxations because the subluxation is predicated on the misalignments of the vertebrae that comprise the subluxation.

The main causes of error of direction in the delivery of the adjustic force are (1) inaccurate film analysis that sets up wrong vectors, and (2) improper adjustic stance. Improper adjustic stance results from many reasons which will be discussed later. Probably the greatest cause, however, of improper stance, and certainly the one that causes the greatest problem in reducing large rotations and excursions of the cervical spine from the verical axis of the body, is too little conversion of the adjuster's shoulder and pelvic levers so that they are at right angles to the notch-transverse resultant or reduction pathway at the moment of the delivery. If the adjuster's shoulder and pelvic levers are not at right angles to the reduction pathway, the parallel forces (action lines) of the adjustment are ineffective in making a correction (see Fig. 2). It is comparable to striking a vertical nail from an angle with a hammer.

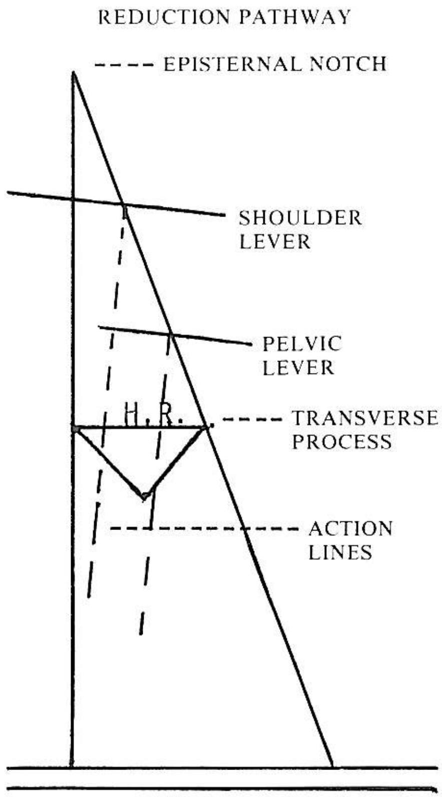
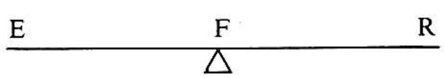


FIGURE 2

Adjuster's shoulder and pelvic levers not at right angles to the reduction pathway, diverting the action lines.

The error of increasing the resistance to the shoulder lever occurs when the adjuster does not relax his shoulders. The C1 adjuster is a first class lever, the triceps are the effort, the glenohumeral joints are the fulcra, and the shoulder girdle is the resistance (Fig. 3). If the resistance of the lever is increased, the lever will not balance until the effort is proportionately increased. If, therefore, the adjuster contracts his shoulder girdle, his triceps must do more work, making the adjustment more difficult and less effective in terms of reducing the subluxation.



FIRST CLASS LEVER

E (Effort): Triceps brachii contraction

F (Fulcrum): Shoulder joint axis of motion

R (Resistance): Shoulder girdle.

FIGURE 3

Because an adjustment is "light," however, it does not follow that the adjustment is effective. The adjustment that is light and effective results from an accurate analysis of the patient's films, computing the correct force vectors, proper adjustic position for any given subluxation, the adjuster's control of force and depth, an understanding of the resistance factors that must be overcome to reduce the subluxation, and proper headpiece placement according to type case.

Speed, like force, is often relied on when adjusting upper cervical vertebrae to improve the quality of the adjustment. But speed is an error in adjusting because too great a velocity can disrupt the sequence of the adjustic movements in the adjuster's body. The triceps brachii, for example, cannot be fully contracted at great speed. If these muscles are not fully contracted, the shoulder girdle does not completely compress, and follow-through—the continuation of momentum generated by the triceps—does not overcome the adjuster's body inertia.

To remedy the errors of force and depth, the adjuster should initiate his/her adjustic forces by contracting the triceps brachii along their line of pull, a straight line between the insertion of the triceps in the olecranon process of the ulnar bone and the origin of the muscle's long head in the infraglenoid tuberosity of the scapula (Fig. 4). The direction of the pull in the

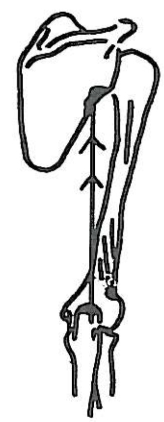


FIGURE 4
LINE OF PULL

adjustic position is upward and somewhat medialward.

The concept of functional reversibility states that muscles pull from origin to insertion or from insertion to origin.[2] The triceps brachii function usually to adduct the humeri. In the C1 adjustment, however, the triceps are pulled from insertion to origin. The force initiated by the triceps is upward into the adjuster's shoulder girdle, not downward into the patient's neck. The adjuster's shoulder girdle is compressed by the upward bilateral muscular contraction, the episternal notch is extended, and the inertia of the adjuster's body is overcome. The error of a downward adjustic force into the patient's neck is avoided.

Kinesiologists state that the shoulder girdle can be compared to a three link chain. Movements, they say, at the glenohumeral joints are always accompanied by accommodating movements of associated osseous structures.[3] In the C1 adjustment, the primary movement is the upward and slightly inward movement of the humeri, initiated by the contraction of the triceps brachii from a point immediately below the glenohumeral joints. Contraction of the triceps in this manner compresses the shoulder girdle, moves the scapulae medialward, and extends the episternal notch. In this manner, the adjuster's action lines are activated. As the adjuster's shoulder girdle compression reaches a point equal to the resistance offered by the C1 subluxation complex, the subluxated vertebrae move. If all the analytical facts are accurately computed and the adjuster's performance without error, the misaligned vertebrae are reduced to their maximum under conditions of a controlled force and depth.

Control of force implies that the adjustic forces (action lines) must be directed along the reduction pathway, maintained within a slight depth dimension, and not permitted to exceed the amount of resistance offered by the C1 subluxation. To accomplish this, the adjustic forces must be developed within the adjuster's body and largely contained therein with only that amount of force permitted to enter the patient's neck that is sufficient to overcome the resistances of the C1 subluxation.

Another error commonly observed is the establishment of the base of support. The base of support, of course, varies with different subluxations. If it is not properly positioned to the horizontal resultant (HR) at the correct settleback point for that particular subluxation, the height and rotation vectors may be shortened, a cause of loss in misalignment reduction (Fig. 5). These vectors determine the length of the HR and the adjuster's position in any given subluxation to it.

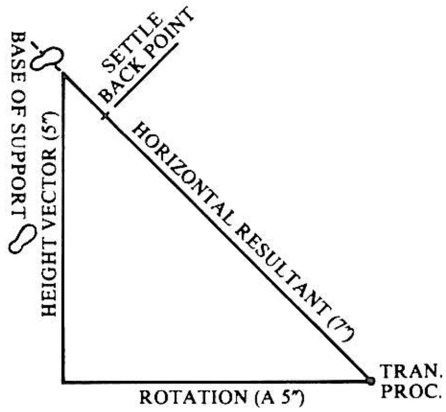


FIGURE 5

Aligning the adjuster's feet (base of support) to the horizontal resultant.

The length of the HR determines the spread of the adjuster's feet from anterior to posterior. The longer the HR, the greater the spread so as to obtain increased angulation of the pelvic and shoulder levers. Error occurs when the foot spread is not sufficiently long to align the pelvic and shoulder levers at a 90° angle to the reduction pathway. If the pelvic and shoulder levers are not exactly at right angles to the reduction pathway, the adjuster's action lines will not be collinear with the reduction pathway.

Associated with the foot-spread error is the problem of improper weight distribution. When advancing the outside leg to establish the AP dimension of the base of support, the tendency is for the adjuster's weight to gravitate to the inside leg, preventing the adjuster from controlling his/her center of gravity after turning over the contact point. The error is compounded when the adjuster attempts to convert his/her body back to the settleback point on the HR at which point the greater weight of the adjuster's body must be over his/her outside leg. The adjuster is, in effect, locked by his own center of gravity.

The remedy for controlling the center of gravity is quite simple. When the adjuster advances his/her outside leg to establish the AP base of support, more of his/her body weight should rest on the outside or forward foot. As the adjuster turns his/her trunk over the contact point (atlas transverse), the tendency for the greater body weight to shift to the inside foot is greater because the adjuster's center of gravity is moving in that direction as his/her body moves. If the adjuster turns over the contact point from his/her ankles, strictly confining the motion to the ankles, the tendency for the body weight to shift to the inside foot is lessened because body gravity is controlled by the movement.

The adjuster who permits his/her body weight to move to the outside leg will automatically twist his/her pelvic lever from a 90° angle to the spinal column. A twisted pelvic lever results in an action line that is not collinear with the reduction pathway, a cardinal rule of adjusting.

The adjustic error of bending the knee of the outside leg when setting up the base of support also twists the pelvic lever from a right angle relationship to the adjuster's spinal column (Fig. 6). Center of gravity distribution is, of course, to the inside leg because

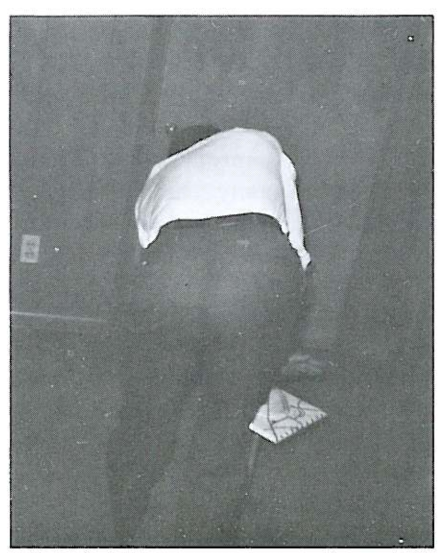


FIGURE 6

the greater weight cannot be maintained over a leg with a bent knee. The adjustic action lines, consequently, are turned away from the reduction pathway, causing loss of reduction of the vertebral misalignments.

Errors can also occur when establishing the lateral width of the base of support. If the base is too wide, pelvic angulation is reduced proportionately. The remedy is to restrict the width dimension of the base to a distance approximately equal to a line drawn from one acetablum to its mate. This line also represents the adjuster's pelvic lever, and coincides with the adjuster's build. The angulation of the components of force coming up the adjuster's legs are thereby controlled, helping to maintain pelvic balance.

Bending over instead of settling back in the settleback phase constitutes a grave error. The purpose of this phase is to convert the adjuster's body to a more vertical plane in preparation for aligning the action lines to the reduction pathway. The act of bending from the hips does nothing to angle the action lines. In fact the action lines tend to fold toward each other. In the adjustic acts which follow the settleback phase, the required conversion of the adjuster's body cannot be regained. Whenever the action lines are not collinear with the reduction pathway, correction or reductions of the vertebral misalignments are not possible.

More adjustic errors occur in the roll-in phase than in any single phase. This phase functions to bring the divergent forces emanating from the contraction of the triceps brachii to a single point: the pisiform bone of the contact wrist. It is, therefore, vital to misalignment reduction that the steps of the roll-in phase be executed properly to prevent a scattering of the adjustic force about the C1 transverse process, locking the vertebra.

When taking contact on the patient's transverse process, the contact hand must be drawn back at approximately a 45° angle to the patient's neck. If the contact hand approximates a 90° angle, the error will cause resistance to the adjustment from the patient's mastoid bone, and the adjustic force will enter the skull rather than the vertebra.

Frequently, the adjuster's contact hand is flexed dorsally, causing the arch to break down in the adjustment, scattering the adjustic force about the transverse of C1. This error is corrected by forming the contact arch so that a fairly flat surface is maintained along the dorsal surface of the hand and wrist. If the contact arch breaks down during the adjustment, the resistance it affords the triceps pull will be weakened, and consequently, the shoulder lever will not be completely activated first. Efficient movement in a motor skill requires that the lever having the largest mass move first in the sequence of movement.[4] The lever with the greatest mass in the adjustment is the shoulder lever and should move first in the sequence, and its movement should not be hampered by either elbow action or by a breakdown of the contact arch.

The thumb of contact hand should be adducted toward the radial bone of contact arm, and the thumb positioned toward the dorsal surface of the hand. Failure to so position the thumb may cause loss of control of the divergent forces. The metacarpals of the contact hand should be stretched and rigidity maintained throughout the adjustment. The contact arm, however, should be relaxed so that triceps contraction is easy.

One of the purposes of the roll-in phase is to accurately align the wrist levers. These levers extend from the fossa at the base of the thumb formed by the tendons of the extensor pollicis longus and the extensor pollicis brevis muscles to the distal end of the pisiform bone. (This fossa is sometimes referred to as the anatomic snuffbox.) The adjustic forces emanating from the triceps contraction are brought to a single point when the wrist levers are accurately aligned. The error occurs when the wrist levers are not aligned and the contact wrist lever is forced downward, breaking the arch and curving the adjustic force upward against the contact point. This error can cause increase of lateral misalignment of C1 on the condyles of occiput.

Correction of this very common error requires that the roll-in hand be drawn back at a 90° angle to the radial bone of contact arm until this pisiform bone of roll-in twist inserts securely into the posterior aspect of the anatomic fossa of contact twist. Pulling back with the contact arm from the shoulder against the rolled-in pisiform of roll-in wrist aids in keeping pressure in the anatomic fossa. It will, furthermore, lessen the pressure on the patient's neck as a heavy contact impedes triceps contraction and tends to lock the C1 vertebra on the occipital condyles.

The roll-in action is accomplished by turning the ball of the humerus of roll-in arm forward, confining the center of motion to the glenohumeral joint. This action establishes a pivot motion of the roll-in pisiform bone in the anatomic fossa. The error most frequently observed is that of simply turning the roll-in hand in the anatomic fossa which does not align the wrist levers.

The action of turning the humerus ball forward (when in the adjustic position) in the glenohumeral joint forces the thumb of roll-in hand behind the wrist of contact arm. The humerus ball must be turned until the thumb of roll-in hand is at an approximate 90° angle to the radial bone of contact arm. If the thumb extends parallel to the radial bone of contact arm, the wrist break cannot be completed, and the incorrectly positioned thumb will cause the pisiform bone of roll-in wrist to kick out of the anatomic fossa in the adjustment.

After the pisiform bone of roll-in wrist is secured in the anatomic fossa of contact wrist, and the thumb of roll-in hand is correctly positioned behind the wrist of contact arm, the humerus ball of roll-in arm is turned backward in the glenohumeral joint. This action further secures the pisiform bone in the anatomic fossa. The wrist lever of roll-in arm, which was forced back at about a 45° angle by the forward turning of the humerus ball, must be held at that angle and not permitted to slip upward from the pressure exerted on it. If the wrist lever does slip upward, it will prevent the next step, the wrist break.

The wrist-break is accomplished by turning the wrist lever of the roll-in arm upward at an approximate 90°

angle to the radial bone of the contact arm. It is this action that brings the levers of both wrists into alignment. The thumb of the roll-in hand may be permitted to slip on the wrist of the contact arm until the wrist levers align. The center of motion in the wrist break is strictly confined to the distal end of the pisiform bone of roll-in wrist.

The fingers of roll-in hand are then turned from the proximal knuckle joints toward the ends of the fingers of the contact hand. In this action the centers of motion must be confined to the knuckle joints between the first phalanges of the fingers and the metacarpals. When the fingers are turned, they are rapidly dropped around the wrist of the contact arm. This action maintains the lever of roll-in wrist in alignment with the lever of contact wrist. The radial bone of the contact arm, when the wrist-break is completed, should rest against the first phalange of the thumb of the roll-in hand, and the knuckles of roll-in hand should parallel the radial bone of contact arm.

A roll-in hand that is securely locked into the anatomic fossa of contact wrist can be relaxed at the moment of the triceps contraction. If it is kept contracted, this fault will add resistance to the triceps contraction. As the triceps are contracted, however, the relaxed roll-in hand automatically tightens against the wrist of the contact arm, and the ring finger of roll-in hand tightens against the wrist of contact arm, further securing the pisiform-fossa relationship.

Another error in the roll-in phase is the tendency to use the elbow of the roll-in arm to assist in making the wrist-break. This fault should be avoided by keeping the center of motion in the wrist-break action confined solely to the anatomic fossa. That is to say, that no assistance should be provided by the elbow being brought downward, because it reduces the degree to which the wrist lever of the roll-in arm can be turned.

At this point in the adjustment, the adjuster is over the contact point. After he/she has completed the roll-in phase, the episternal notch must be returned to the settleback point on the HR at a 90° degree angle to the HR. Returning the episternal notch to the settleback point is a function of the conversion phase. The common fault in this phase is when the adjuster simply swings his body back to the settleback point. The correct procedure is to bring the adjuster's trunk back to the settleback point and, at the same time, convert the trunk to a more vertical position, aligning the action lines more nearly to the plane of the reduction pathway.

To remedy the error of faulty conversion, the adjuster's spinal lever must be rotated from a point high in the adjuster's spinal column. This point or axis of motion is the adjuster's episternal notch. The action is accomplished by the adjuster pushing his trunk backward along a plane from his/her outside shoulder to the inside hip. The adjuster's body is thereby converted to a more vertical plane as it moves slowly back to the settleback point. In executing this act, the adjuster must be careful to keep his/her greater weight on the outside foot, and increase the hip-lock action in the anterior-inferior aspect of the outside hip.

The conversion phase completed, the adjuster may find that his/her trunk is not situated at a 90° angle to the HR at the settleback point. Further, his/her tie or plumbob may not fall one inch beyond the HR. These faults indicate that the adjuster's base of support was incorrectly located in relation to the HR when first established, or that the conversion phase was not fully and correctly completed. In the first instance, the adjuster must start over and re-locate his/her base until it is perfect alignment. If the error is in the conversion phase, the adjuster failed to obtain sufficient angulation when he/she settled back from outside shoulder to inside hip.

Settling back with the trunk in either the settleback phase or the conversion phase frequently presents a problem to the adjuster which he/she attributes to lack of flexibility. The problem is not due to muscular limitation, but to lack of pelvic rotation to a more vertical plane. If the adjuster will hold his/her "locked" position for a moment, then consciously relax the lumbo-sacral musculature, he/she will find that the pelvis will rotate easily to a more vertical plane, permitting an easy continuation of the settleback action.

Contracting the triceps brachii in the final or kinetic phase seems quite difficult to master. Generally, the fault is that the point from which the muscles are pulled is too low in the arms; it should be initiated from a point not lower than two inches below the glenohumeral joints. The nearer the pull is started to the insertion of the muscles in the olecronon processes, the more the action lines will bend at their distal ends, locking the C1 vertebra.

The remedy is simply one of practice until the triceps muscles can be controlled. Adjusting against a solid wall and completing the shoulder action is a good method of learning triceps pull.

The triceps pull phase is the kinetic phase of the C1 motor skill. This phase sets in motion the potential phases of the adjustment. If any of the potential phases are not executed properly, the errors will be expressed at the time of the triceps contraction and the shoulder compression. The post x-ray will reflect these errors in terms of loss of maximal reduction or correction or in increases in the misalignment factors of the C1 subluxation.

Conclusion

The major errors that prevent reductions of the misalignment factors of the C1 subluxation have been discussed in this paper. Also discussed are the remedies which have been tested against post x-ray. Doubtless, errors exist that are peculiar to individual adjusters which cannot be considered here, but generally speaking, the most common errors were discussed. If there is one common fault, however, it is that few adjusters see the C1 adjustment in terms of aligning their bodies so that the action lines lie in the same plane as the reduction pathway. Like all motor skills, the C1 adjustment is predicated on well known and relevant mechanical and kinesiological principles and concepts. If these principles and concepts are understood and applied by the adjuster, the adjustment (correction) of the C1 subluxation is not a difficult procedure.

References

[1]Gregory, R. R. & Seemann, D. C., Analyses of Some Hypotheses About The Atlas Subluxation Complex, *Digest of Chiropractic Economics*, January-February, 1976.

[2]Groves, R. & Camaione, D. N., *Concepts in Kinesiology*, W. B. Saungers Co., Philadelphia, 1975, p. 35.

[3]*Ibid.*, p. 53.

[4]*Ibid.*, p. 71.

New Equipment Purchased

NUCCA has purchased two important equipment systems during the past few months to enhance the ongoing training and research programs for its members.

Members who attended the fall seminar in November were exposed to the four new pieces of training equipment: a tuner, cassette recorder, a color video camera and a large 48 inch screen and projector. Color videotapes were prepared in advance of the seminar and were presented as part of the fall program. The attendees were enthusiastic with the quality of the instruction that was presented.

The other equipment system purchased was the Rainbow 100 Computer which is made by Digital Equipment Corporation. Also purchased was a printer and the appropriate software systems to complement the computer. Information on 1,000 patients has already been put on floppy discs and the update of the 1972 study on upper cervical relationships is in progress and will be published in the next *Monograph.*

Purchase of the equipment systems was made possible by donations to the NUCCRA Ruth O. Gregory Memorial Fund.

Change of Address

Many MONOGRAPH copies and other NUCCA and NUCCRA material are returned because of the subscriber's change of address. Please notify the NUCCA editor, 221 West Second Street, Monroe, Michigan 48161, of any change of address.

NUCCA SCHOLARSHIP AWARDS

The NUCCA Board of Directors has authorized a scholarship grant-in-aid award of $200.00. The award will be paid to chiropractic students currently enrolled in a chartered college of chiropractic who submit to the Monograph editor an acceptable article pertaining to the upper cervical spine.

Submitted articles should relate to the Occipital-atlanto-axial spine. They may relate to biomechanics of the cervical spine, analysis of cervical subluxations, corrective techniques for cervical subluxation, detrimental effects of C1 subluxations on the spinal column (distortion), or any other phase of chiropractic in which the upper cervical subluxation is shown to be an etiogenic factor.

Articles must be accurately and properly referenced. All entries will be judged by the NUCCA Board and by Daniel C. Seemann, Ph.D., NUCCA Executive Director. Accepted articles become the property of the National Upper Cervical Chiropractic Association, Inc. (NUCCA). The names of the authors of the accepted manuscripts will be announced at the next NUCCA Convention. Payment of the award will be made upon acceptance of the article.

NUCCA will attempt to return all manuscripts that are accompanied by a self-addressed, stamped envelope. The organization will not be responsible for lost or mislaid submitted material. The judgment of the NUCCA Board of Directors will be final. The writer should retain a carbon copy.

Students are encouraged to submit articles.

Further information is available by writing:

NUCCA MONOGRAPH
EDITOR
217 West Second Street
Monroe, Michigan 48161

The 1983 November NUCCA Seminar

The 1983 November NUCCA Seminar was held at the Howard Johnson Motor in Monroe, Michigan from November 5th through November 9th. The HJ Conference room was filled to capacity with doctors from throughout the United States and Canada. Students from chiropractic colleges also attended.

The seminar was supervised by Daniel C. Seemann, Ph.D., The University of Toledo. Instructors assisting were Drs. M. Dickholtz, K. E. Denton, A. A. Berti, Lloyd Pond, and R. R. Gregory.

Doctors and students were divided into categories corresponding to subjects taught: X-ray analysis, leg-checking exercises, adjusting exercises, adjusting problems, biomechanical problems, and headpiece placement for different type C1 subluxations. It was a "hands on" practical program.

Previously prepared videotapes on x-ray analysis, advanced adjusting technique, adjusting errors, x-ray machine alignment, and patient placement on x-ray equipment were shown on a large screen. Adjusting practice was also videotaped in the seminar so that doctors could observe themselves and criticize their own errors as a learning tool.

General discussion of all exercises was participated in by the registrants and compared with school solutions.

The 1984 NUCCA Convention And Educational Conference

The 1984 NUCCA Convention and Educational Conference will be held at the Howard Johnson Motor Lodge, 1440 North Dixie, Monroe, Michigan. It will start Saturday, May 5th at 8:00 a.m. and close on Tuesday, May 8th at noon. The Educational Conference will be co-sponsored by The University of Toledo. A Certification of Completion will be awarded those registrants who attend all educational sessions by the University's Division of Continuing Education.

Convention chairman will be Dr. Glen Cripe of California.

The theme of the Convention is *Biomechanics of the C1 Subluxation Complex.*

Participants who intend to apply for license-renewal credits in their states based on the Educational Conference must attend all educational sessions. Their attendance at each session will be monitored by NUCCA and recorded on NUCCA attendance cards. Daniel C. Seemann, Ph.D., professor at The University of Toledo and advisor to the National Upper Cervical Chiropractic Research Association, Inc. (NUCCRA) will supervise the Educational Conference.

Subjects will include basic and advanced x-ray analysis, classifications of the C1 subluxation complex, patient placement on the adjusting table for each basic type subluxation, C1 subluxation mechanical levers, resistances to the C1 adjustment, anatometer exercises, supine leg-check exercises, adjusting technique, biomechanical problem exercises, and adjustment problem exercises.

Prepared videotape presentations will include: Identification of Osseous Structures in Upper Cervical Film Analysis; Adjusting Errors, X-ray Machine Alignment, and Patient Placement on the X-ray Machine for Upper Cervical X-ray.

James F. Palmer, M.S., The University of Toledo, will lecture on *Basic Physics of the C1 Adjustment.*

Fees for professionals are $350.00. For doctors in practice for two years or less, the fee is $200.00. Students are admitted for $150.00. The registration fee includes membership in NUCCA for one year.

NUCCA will host a banquet on Monday evening, May 7, 1984 at 7:30 p.m.

Income from the Convention above expenses will be donated to NUCCRA research of the vertebral subluxation.

The deadline for registering is March 20, 1984.

Further information may be obtained by writing NUCCA, 217 West Second Street, Monroe, Michigan 48161.

Ruth O. Gregory Memorial Fund

The **National Upper Cervical Chiropractic Research Association, Inc.** (NUCCRA) extends its its heartfelt thanks to the contributors listed who recently so generously gave to the Ruth O. Gregory Memorial Fund. These donations are deeply appreciated.

The NUCCRA Directive Board at its 1982 November meeting unanimously voted to establish a Memorial Fund in appreciation for the time and effort so selflessly given by Ruth O. Gregory to the NUCCA-NUCCRA Organizations that subluxation-minded chiropractors could benefit from NUCCRA research of the C1 subluxation and its effects on the human body.

Since the death of Ruth O. Gregory in June of 1982, many donations have been received by NUCCRA and used to further research, a concept in which she so firmly believed. It was the feeling of the NUCCRA Board that, through this Memorial Fund, Ruth O. Gregory's great interest in chiropractic and her desire to help chiropractors would be continued. Thus the Fund is a tribute to her memory.

Recent donations to the Ruth O. Gregory Memorial are:

Dr. & Mrs. Cohen	Illinois
Dr. Dan Fedeli	Illinois
Dr. W. G. Laney	Washington
Mrs. Marynelle Sheilds	Indiana
Dr. S. Schroeder	Oklahoma
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Dr. Donald K. Moon	Ohio
Mr. B. Bushman	Oklahoma
Dr. B. O'Brien	Hawaii
Dr. R. R. Gregory	Michigan

NOTICE

The fees set by the NUCCA Board of Directors for applicants taking the Certification Tests are as follows:

1st Segment -	$50.00
2nd Segment -	$100.00
3rd Segment -	$100.00

Fees are payable prior to taking each segment. Applicants should make checks payable to NUCCA, Inc.

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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. Doctors who successfully complete the program will be eligible to conduct and teach basic classes. A certification committee will be established from the initial group of doctors first certified. Examinations will be given at NUCCA seminars and conventions.

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 in two years. Certificates will be issued successful candidates.

Doctors who have not engaged in practice for three years but who have attended NUCCA seminars are eligible to take the examination which covers a two-year period. A fee is charged each candidate. In the event of failure of the examination, or any part thereof, the candidate is re-examined in the part of the examination he failed without paying an additional fee, provided re-examination takes place within the two-year period.

Certification will be evaluated every three to five 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 ten sets of cervical films suitable for analysis
   - D. Examination on X-ray procedures
   - E. Submit a set of x-ray alignment films
   - F. Examination on instrumentation

2. FILM ANALYSIS
   - A. Knowledge of osseous structures
   - B. Read ten sets of cervical spinal x-rays with an inter-observer reliability of .90
   - C. Examination of film analysis

3. ADJUSTING
   - A. Submit ten sets of consecutive pre and post cervical x-rays. The post x-rays presented to the examining board be those taken after the initial adjustment. Reductions in the height and rotation vectors to be evaluated at the discretion of the examining board.
   - B. Oral examination in which the candidate is given various listings for which he is to explain reduction procedures.
   - C. Written examination on adjusting. 100 questions with a passing grade of 85.

In Memoriam

Dr. Clarence L. Brady

Subsequent to the publication of the July issue of the Upper Cervical *MONOGRAPH,* NUCCA received word of the death of Dr. Clarence L. Brady, age 65, on July 4, 1983 in Medical Center Hospital.

Dr. Brady was a member and supporter of NUCCA for many years. He practiced in Odessa, Texas for 32 years, having received his degree from the Palmer College of Chiropractic in 1947. He was a member of the Bellmont Baptist Church, the Texas Chiropractic Society, International Chiropractors Association, and the Permian Booster Club.

Survivors include his wife, Norma; a son, Gordon Lloyd Brady of Odessa; one daughter, Gwendolyn Hendrix of Odessa; two brothers, Keith Brady of Casper, Wyo., and Eugene Brady of Middleville, Texas; four sisters, Ruth Eddy of Delton, Mich., Loita Stotz and Muriel Jarstafer of Battlecreek, Mich., and Byrle Hudson of Kokomo, Ind.

The *Monograph* extends its heartfelt sympathy to Mrs. Norma Brady and members of the family.