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Some Hypotheses As To How Rotations Are Produced With Cervical Subluxations

By Daniel C. Seemann, Ph.D.

Statistically, the information that is available about rotations of C1 have remained fairly constant since 1972 (Seemann, 1972). Anterior rotations occur in 68% of the cases and posteriors, 32%. With the classification of subluxations by Gregory (1981, 1982) into the four basic types more information is now available about the rotatory behavior. The new NUCCA computer has generated the following data from 1000 cases. That 77% of type 2 subluxations are anterior and 75% of type 3 subluxations are anterior, and 68% of all the posterior rotations are type 1 subluxations.

These patterns raise several questions as to why more anterior rotations are found, why more anteriors are found with basic type 2 and 3 subluxations and why more posteriors are found with the basic type 1 subluxation. The fact these patterns have remained consistent suggest that a predictable biomechanical relationship exists which produces anterior or posterior rotations. The clues as to how may be found in examining the center of gravity of the skull in the frontal and saggital planes as it relates to occipital-atlanto-axial complex.

The center of gravity studies (Seemann, 1982) have been helpful with head placement where it was determined that the CG of the skull in the frontal plane was located at the apex of central skull line and the level of the orbits of the eyes (see Figure 1). If the skull is tilted, the CG of the skull

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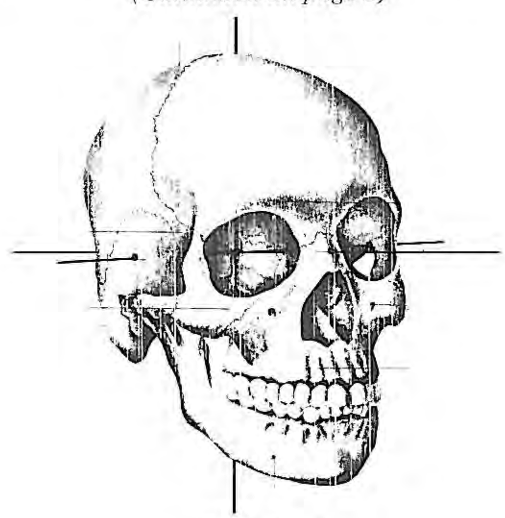

FIGURE 1
CENTER OF GRAVITY OF THE SKULL IN ALL PLANES.

Some Basic Concepts of Mechanics

By James Palmer

Mechanics is the science of motion of real objects. It is subdivided into statics, which deals with the forces acting on objects that are at rest, and dynamics, which deals with the forces acting on objects and the motion caused by these forces.

Dynamics is subdivided into kinematics, which deals with the motion of objects without regard to the forces causing the motion, and kinetics, which deals with the relationships between the forces acting on an object and the object's resulting motion.

Motion of an object is described by its position at every instant of time. We describe position by assuming an "Average Position"; effectively we have a center of mass (center of gravity) that defines the "Average Position" of an object. Position is determined by measurements relative to a frame of reference. These measurements express magnitude (size or extent), direction, and sense.

Vectors are mathematical entities that express magnitude, direction, and sense and satisfy certain laws. Displacement, velocity, acceleration, force, momentum, and torque are vector quantities. Scalars are mathematical entities that express only magnitude and therefore do not depend on the coordinate system used. Time, mass, speed, energy, work, and power are scalar quantities.

A force is a "Push or a Pull". All forces discussed are external forces. If an object has only a single force acting on it, then the object will be accelerated by the force in the direction of the applied force, the magnitude of the acceleration being equal to the ratio of the applied force and the

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will change. A vertical line dropped from the apex point will determine where the weight of the skull is bearing on the axial circle (see Figure 2). Where the weight of the skull rests must determine how the atlas rotates with respect to the skull and the axis. Figure 3 shows a Type 1 subluxation.

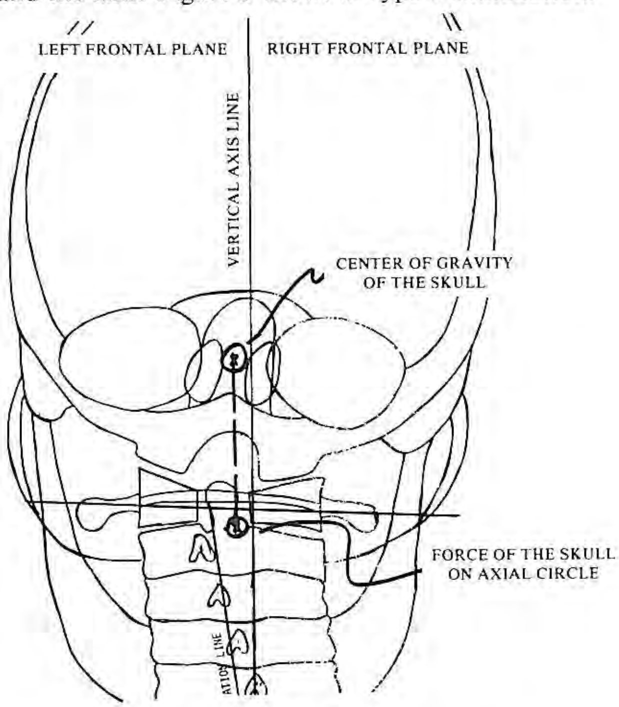

FIGURE 2
CENTER OF GRAVITY OF THE SKULL
IN A STATE OF DISEQUILIBRIUM

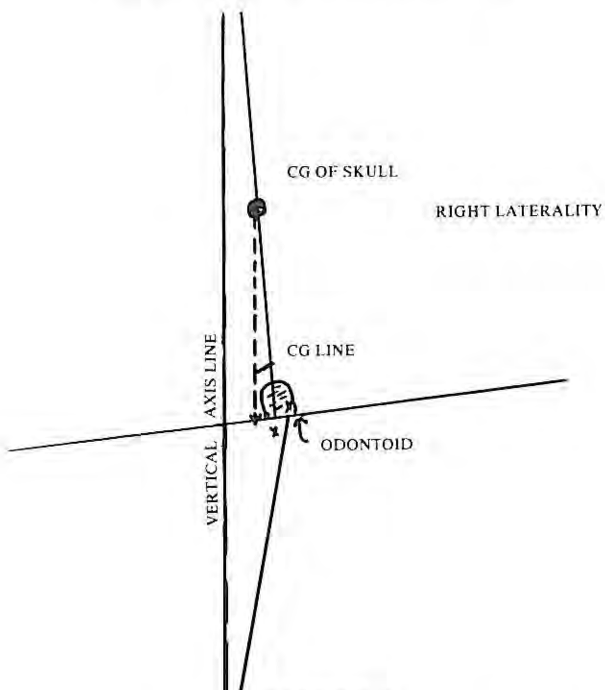

FIGURE 3
CENTER OF GRAVITY BASIC TYPE 1
SUBLUXATION. SIDE OPPOSITE LATERALITY.

There is a right laterality and a lower left angle. The skull is slightly tilted toward the vertical axis line and the vertical axis line is to the left of the odontoid process. A vertical line has been dropped from the center of gravity of the skull which is also slightly to the left of the center of the odontoid process. The model suggests that with type 1 subluxations, the weight of the skull in general falls to the side opposite laterality.

With type 2 subluxations the skull will turn toward the vertical axis line and the lower angle is on the same side as laterality. In Figure 4 there is a right laterality and the

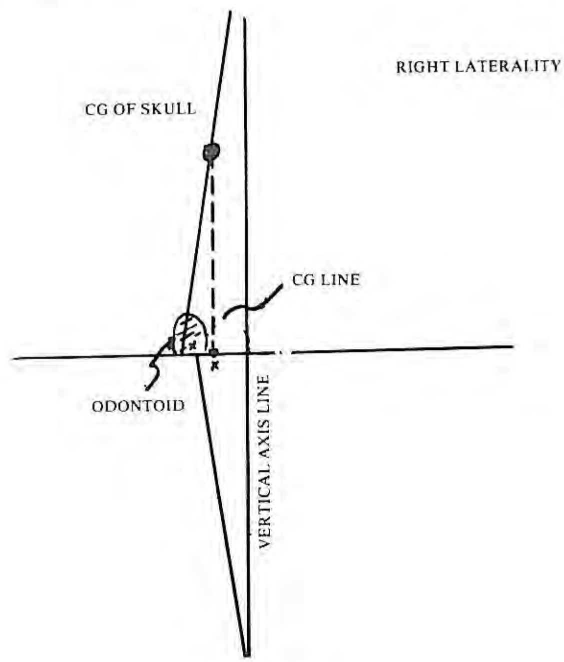

FIGURE 4
CENTER OF GRAVITY BASIC TYPE 2
SUBLUXATION. SIDE OF LATERALITY.

vertical axis is to the right of the odontoid process. The vertical line that has been dropped from the center of gravity of the skull is also to the right of the mid-point of the odontoid. The weight of the skull has shifted to the side of laterality.

Type 3 subluxations are similar to type 2 because the skull will tilt toward the side of laterality and the weight of the skull will locate on the same side as laterality.

The atlas is the transitional vertebra and rotation depends on the position of the skull in relationship to the axial circle. The downward force of the skull is translated through the facets of the occiput, the facets of the atlas and the superior facets of the axis. The type of subluxation evidently influences the type of rotation that is produced. With type 1 subluxations, there is usually a greater lateral shift where the atlas will move around and up the skull and the lower angle is usually quite large. This is different than type 2 and 3 subluxations where the skull rotates toward the vertical axis and the atlas plane line remains fairly level. All these factors which are still not entirely understood contribute to the production of anterior or posterior rotations.

Concept of the Long and Short Axis

When there is an equal pressure on the facets of the superior articulating surface of the axis all three components: the skull, atlas and the axis are aligned on the vertical axis. Obviously when they are not aligned a misalignment occurs.

When a misalignment occurs, the skull force will be directed to either side of the mid-point of the odontoid process depending on whether the skull turns away or toward the subluxation. If the skull turns toward the subluxation, the center of gravity of the skull will fall on the side of laterality and is called "the short axis" because the axis of rotation is located on the side of laterality. (See Figure 5.) If

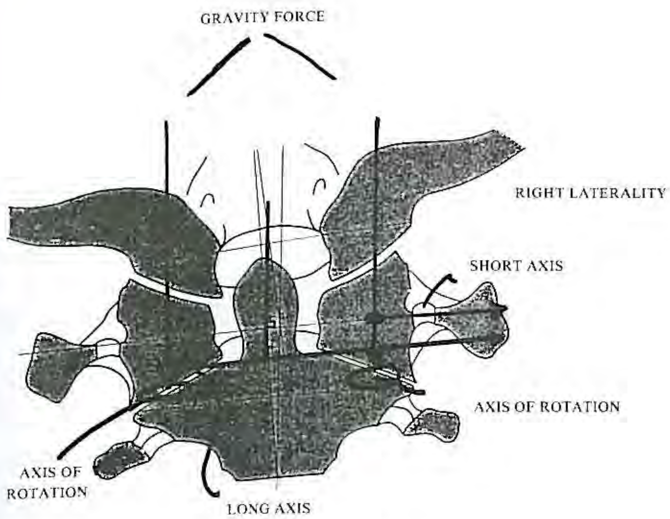

FIGURE 5
AXIAL ROTATION AND THE LONG AND SHORT AXIS.

the skull turns away from the subluxation, the center of gravity of the skull will fall opposite to the side of laterality and is called the "long axis," because the axis of rotation is opposite to the side of laterality.

White and Punjabi (1978) recognize that it is possible for the axis of rotation to center at either facet of the atlas and it is possible to have a long or short rotation depending on which side the atlas rotates. They indicate that regardless of the facet involved, the rotation would be anterior. It is the writer's position that the plane line and center of gravity that determines how the atlas will rotate, either anterior or posterior.

If it is a gravity force that produces the rotation then the plane line must also be involved. Gregory (1981, 1982) has indicated that with most type 1 subluxations, when there is a high plane line and the skull has turned toward the vertical axis line, there almost always is a posterior rotation. If the skull tilts toward the vertical axis line the gravity force should fall to the opposite side of laterality, which establishes the long axis of rotation. The plane line will be high on the side of laterality. The atlas being in a state of disequilibrium will attempt to accommodate the force of the skull and the position of the axis by rotating posterior from the long axis. The atlas rotates posteriorally because the atlas attempts to become level and this is dictated by the position of the axis of rotation and the tilt of the skull in the saggital plane. The atlas should not rotate anterior because the atlas would have to overcome the force of gravity of the skull and the tilt of the plane. An analogy would be if a child was in a sled-like disk on the side of a hill and the father had a rope attached to the disk at the same level as the child. When the disk is released by the mother, the child and the disk flow to the bottom of the hill because of gravity. It is not expected that the disk will flow up the hill.

Type 2 and 3 subluxations usually have anterior rotations. With types 2 and 3 there generally is a level plane line and the skull turns toward the vertical axis with the center of gravity falling on the side of laterality. Since the plane line is level with these types of subluxations, the torque from the lower cervicals would normally be anterior turning from the short axis.

This discussion so far generates an hypothesis which is: **"When the center of gravity of the skull falls on the side of laterality in the frontal plane the atlas will rotate anteriorally, and when the center of gravity falls on the side opposite to laterality, the atlas will rotate posteriorally."**

The Saggital Plane

Prior to discussing the saggital plane it is necessary to review a concept from physics concerning the center of gravity and equilibrium (Miller, 1977). A body will be in a state of equilibrium if the center of gravity and the vertical line passes through the point of support. To a certain extent, the same behavior will occur in the horizontal plane if it is uneven. In the transverse plane of the atlas, the same rule should apply. If the atlas is viewed as a horizontal disk (see Figure 6) the atlas would be in a state of equilibrium if the

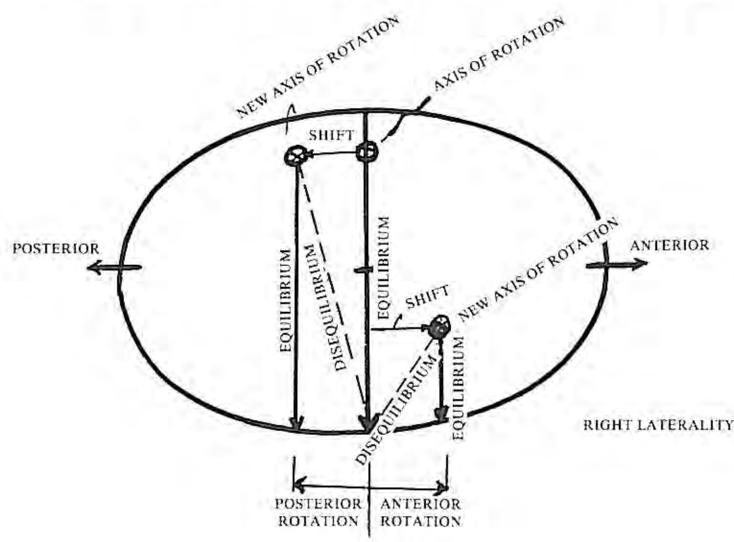

FIGURE 6
THE ATLAS VIEWED AS A HORIZONTAL DISK IN A STATE OF EQUILIBRIUM AND DISEQUILIBRIUM.

CG of the disk ran directly down the center of the disk. And if one viewed the lateral aspects of the disk as the transverse processes one could see there was no rotation because the disk was in a state of equilibrium. Now if the disk became uneven and was tilted, a state of disequilibrium would occur. The two factors which determine the direction the plane turns is where the disk pivots and the side where the CG has fallen. Now if the viewer looked at the disk from the right after the CG had shifted, he would note that disk will have rotated to directly under the pivot point of the new axis. If the CG had shifted to the left as it was viewed from the right the disk would have rotated in a posterior direction. It is helpful to understand this principle from physics before the saggital plane is discussed.

An analysis of the saggital plane has been largely ignored because the only reason the lateral x-ray has been used is to establish the S-line or central ray line and determine whether pathology exists in the cervical vertebrae. But in order to fully understand the mechanics of rotation the saggital plane must be analyzed and related to the frontal and transverse planes. In order to understand the saggital plane some landmarks had to be established which could aid in the analysis.

Again using the previous studies on the center of gravity (Seemann, 1982) it had been determined that the center of gravity of the skull in the saggital plane was located about 3cm above the auditory meatus. And on a lateral x-ray the auditory meatus is easily identified. By dropping a vertical line down through the auditory meatus and squared with the bottom of the x-ray film the center of gravity of the skull in the saggital plane was determined.

A pilot study was started where all the laterals of new patients were marked according to the new center of gravity system. Immediately, new relationships were noticed. The position of the skull seemed to dictate the behavior of the lower cervicals. For an example, if the CG of the skull was anterior to the cervicals the cervical curve tended to be lordotic. If the CG of the skull was posterior to the cervicals the lower cervicals tended to be kyphotic. (See Figure 7.)

Early on it was found that a standard procedure for positioning the skull in the head clamps was necessary, because if the skull was tilted slightly superior or inferior in the saggital plane, consistency in establishing the relationships was jeopardized. It was decided the head would be placed in the clamps in such a way that the Frankfort Line (auditory meatus to the inferior orbit of the eye socket) would be level. This proved to be helpful in establishing a constant for the saggital plane. Some may argue that by maintaining the head level in the clamps the curve will change, but it will not be known whether the curve will change until some sort of constant is established.

With the two procedures, the CG saggital, and the Frankfort Line used in marking the lateral film it was possible to observe the relationships between the center of the condyles of the occiput, the mid-point of the odontoid process, and the CG of the skull descending from the auditory meatus. Three different relationships emerged from the analysis. 1) the center of gravity line fell anterior to the odontoid mid-point and condyles of the occiput (see Figure 8, type A); 2) the center of gravity fell directly through the odontoid mid-point (see Figure 9, type B), and 3) the center of gravity fell between the odontoid mid-point and the center of the condyles of the occiput (posterior to the odontoid mid-point). (See Figure 10, type C.) The value of knowing the different relationships becomes apparent when posterior and anterior rotations were analyzed relative to the saggital plane.

If the CG of the saggital plane falls either posterior or anterior to the mid-point of the odontoid process this should have some influence biomechanically as to how the atlas could rotate. Earlier it was discussed that with type 1 subluxations when the CG of frontal plane fell to the side opposite laterality there usually was a posterior rotation. The prediction with type 1's as to where the CG of the saggital plane falls, is to the posterior of the mid-point of the

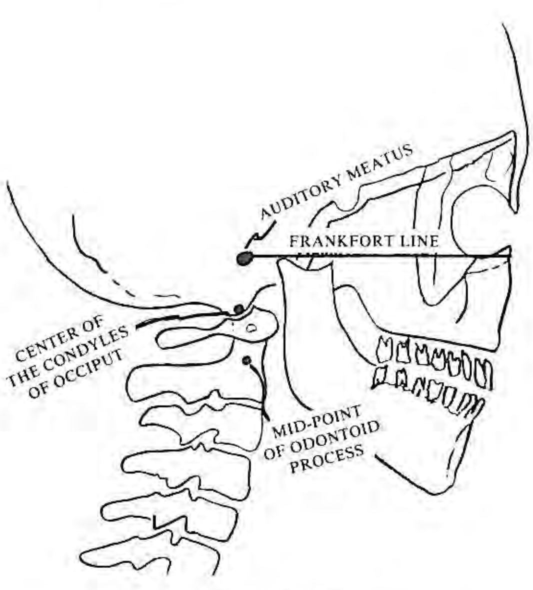

FIGURE 7
LANDMARKS FOR THE ANALYSIS
OF THE SAGGITAL PLANE.

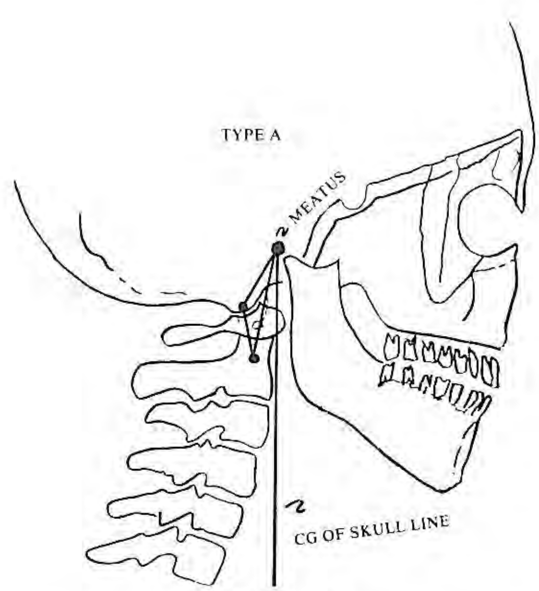

FIGURE 8
A TYPE A POSITION OF THE CG OF
THE SAGGITAL PLANE — ANTERIOR.

odontoid process. This rationale supports the transverse plane model discussed earlier (Figure 7) which hypothesized that if the gravity force is located posterior to the center of the plane the plane will rotate posterior and when the gravity force is located anterior to the center of the plane the plane will rotate anterior.

With type B's the CG of the saggital plane falls directly through the center of the odontoid process. This makes it difficult to predict rotation because there is no A-P tendency. The first alternative is to look at the nasium film to determine which side the gravity force falls. This should give a clue as to the prediction of rotation. For an example, if the saggital plane was a type B and in the frontal plane the CG fell on the same side as laterality the prediction would be anterior. In most cases this will be true, but the pilot study indicated this is not always true. And at this writing those films that have been analyzed and do not fit the pattern are classified as "out of pattern" and will require further analysis. An important point to make here is that by analyzing both the nasium and lateral films a rather high prediction rate as to the tendency to be anterior or posterior was realized.

With the analysis of the saggital plane another hypothesis was generated: which states that **"When the center of gravity in the saggital plane falls anterior to the mid-point of the odontoid process the rotation will be anterior and when the CG falls posterior to the mid-point of the odontoid process the rotation will be posterior."**

Using the hypotheses generated both from the frontal plane and the saggital plane, 24 sets of films (lateral and nasium) were analyzed to determine whether the predictions fit the hypotheses.

Results of the Pilot Study

The analysis of the data was quite simple. If the rotation for the case was anterior and the CG of the frontal plane was on the side of laterality a "yes" was marked for the nasium column. If the CG of the saggital plane was anterior to the mid-point of the odontoid process, the lateral column was marked "yes." Obviously if the rotation did not match the hypothesis the column was marked "no" (see Table 1).

TABLE 1
RESULTS OF THE PREDICTION AS TO WHETHER THE ATLAS ROTATED ANTERIOR OR POSTERIOR.

	Case No.	Type Rotation	Nasium	Lateral
1.	6953	Anterior	yes	yes
2.	6951	Posterior	yes	yes
3.	6950	Anterior	yes	yes
4.	6949	Anterior	no	yes
5.	6948	Anterior	yes	yes
6.	6946	Anterior	no	yes
7.	6954	Posterior	yes	yes
8.	6944	Posterior	yes	yes
9.	6943	Posterior	yes	yes
10.	6942	Anterior	no	no
11.	6941	Anterior	yes	yes
12.	6955	Posterior	yes	no
13.	6940	Anterior	no	yes
14.	6939	Posterior	yes	no
15.	6938	Posterior	yes	yes
16.	6937	Posterior	yes	no
17.	6958	Anterior	yes	yes
18.	6935	Anterior	yes	yes
19.	6934	Posterior	no	no
20.	6933	Anterior	yes	no
21.	6952	Anterior	yes	yes
22.	6960	Anterior	no	yes
23.	6963	Anterior	no	no
24.	6945	Posterior	yes	yes

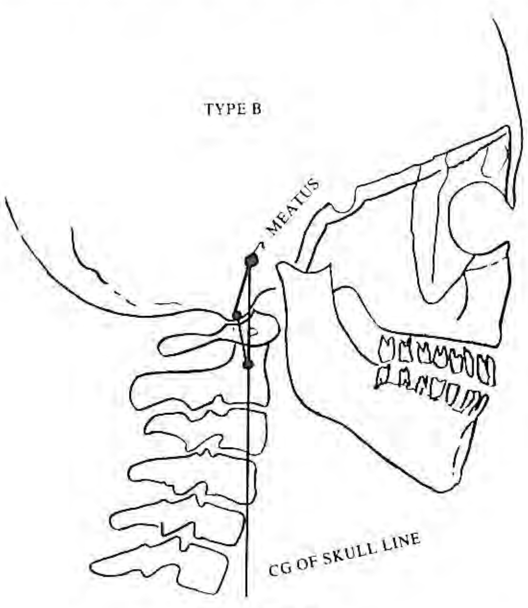

FIGURE 9
A TYPE B POSITION OF THE CG OF THE SAGGITAL PLANE — MID-POINT.

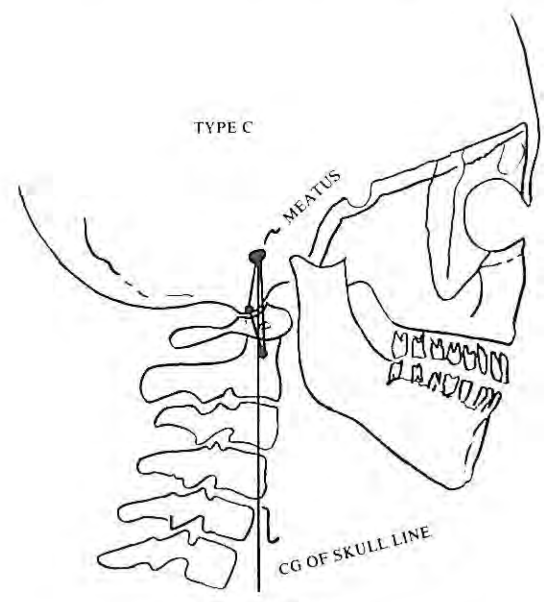

FIGURE 10
A TYPE C POSITION OF THE CG OF THE SAGGITAL PLANE — POSTERIOR.

Of the 24 cases studied, there were three cases where both the nasium and the lateral films did not match the prediction and were marked "no", which is a .875 prediction rate. When each column was analyzed separately, the prediction rate lowered. There were seven "no's" in the nasium column and seven "no's" in the lateral column which for both is a .708 prediction rate. The lowered rate suggests the importance of using both planes in the prediction of rotations. It should also be noted that in 13 of the 24 cases both columns were marked "yes" which is a .55 prediction rate.

Another question that jumps out from the data is: Which rotation is the most difficult to predict? In the nasium column, posterior rotations were predicted correctly 9 out of 10 times for a .90 rate. Anteriors were predicted 8 of 14 times which is a .57 rate. In the lateral column, posteriors were predicted 6 of 10 times which is a .60 rate. Anteriors were predicted 11 of 14 times which is a .78 rate. The data suggests that posteriors are better predicted from the nasium films and anteriors have a better prediction rate from the lateral film. See Table 1 for an analysis of the results.

Discussion

The purpose of this study was to expand our present knowledge of the NUCCA system with regard to the understanding the production of anterior and posterior rotations. As to the question why are there more anterior rotations than posterior rotations (68%-32%) a guarded answer could be that in the biomechanics of the subluxation the center of gravity of the skull in more cases falls on the side of laterality in the frontal plane and falls anterior to the mid-point of the odontoid process in the saggital plane. As to why there are more anteriors found with type 2 and 3 subluxations the answer can be focused better. Type 2 and 3 subluxations favor anterior rotations because the gravity force is on the side of laterality (short axis) and given a level plane line the torque from the lower cervicals produce an anterior rotation. The type 1 subluxation favors a posterior rotation if the plane line is high and the central skull line leans toward the vertical axis, therefore the great majority of posterior rotations are type 1 subluxations (68%), which fall on the long axis.

In general the predictions as to how the rotations were produced were acceptable the first time around. As one starts to deal with the relationships in two planes the combinations become quite complicated: the forces of gravity, the plane line, the slope of the facets, the position of the skull, the odontoid process, and the condyles of the occiput plus other variables which are not apparent at this time all contribute to the magnitude of the problem. But as one piece of the puzzle is understood then other pieces are sure to follow.

Implicit in the discussion of rotations and how they are produced is the value this information has for the improvement of the adjustment. The best analysis system really has no value unless the analysis can be translated into some sort of assistance for the adjuster. At any rate, the NUCCA goal in all of its research programs is to find ways that assist in the reduction of the subluxation with precision and permanence.

References

[1]Gregory, R. R. Biomechanics of the upper cervical plane. Upper Cervical Monograph, Vol. 2, No. 10, January 1981.

[2]Gregory, R. R. Some comments regarding the concept of normal. Upper Cervical Monograph, Vol. 3, No. 3, April 1982.

[3]Miller, F. College Physics, 4th Edition. New York: Harcourt Brace Jovanovich, 1977.

[4]Seemann, D. C. A statistical analysis of some hypotheses about the atlas subluxation complex. Paper presented at the NUCCA convention, Monroe, Mich., May 1972.

[5]Seemann, D. C. Center of gravity of the skull: a review of theories and a pilot study to determine location. JMPT, Vol. 4, No. 3, April 1982.

[6]White & Punjabi. Clinical biomechanics of the spine. Philadelphia; J. B. Lippincott, 1978.

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Some Basic Concepts of Mechanics

(Continued from page 1)

object's mass. (An acceleration is a change in speed, direction, or both.) When more than one force acts on an object the object may or may not be accelerated.

A non-zero, vectorial sum of the applied forces requires an acceleration; a zero vectorial sum of the applied forces requires that there is no acceleration. The vectorial sum of the applied forces is called the resultant or net force. Although it is true that the simultaneous application of forces is equivalent to the vector sum of these forces, it is not necessarily true that successive (in time) application of forces is equivalent to the application of the vector sum of these forces. The resultant force usually is not one of the applied forces. The resultant force is the single force which when applied to the object in place of the actual applied forces would result in identical motion. A non-zero resultant force is an unbalanced force.

An object can have three kinds of motion: translation, rotation, and vibration. A rigid body can have only translation and rotation. A rigid-body moves with pure translational motion if every part of the object undergoes the same displacement in the same time interval. A rigid-body moves with pure rotational motion if each part of the body moves in a circle, the centers of which are on a single straight line called the axis of rotation. It is impossible to rotate an object about two different axes at the same time. The product of a force and its displacement from the axis of rotation is the torque or moment of the force. Torques are a function of the point of application. The direction of application of a force affects the sense of rotation as well as the magnitude of the rotational acceleration.

When a rigid-object is at rest or moves such that its linear and angular velocities are constant, both the linear and the angular accelerations are zero. The resultant of all the forces and the resultant of all the torques acting on such a body are zero, and the rigid-body is said to be in mechanical equilibrium. The mechanical equilibrium is said to be static if the body is at rest (linear and angular velocities are zero); the mechanical equilibrium is said to be dynamic if the body is not at rest but the accelerations are zero (linear and angular velocities are non-zero constants). Six equations are needed to specify mechanical equilibrium—three for translation and three for rotation.

A rigid-object is in rotational equilibrium about any axis if it is in equilibrium about three mutually perpendicular axes. A rigid-object is in rotational but not translational equilibrium when acted on by a force whose line of action passes through the center of gravity (mass).

If the application of any horizontal force tends to lower the center of gravity of an object, then the object is in unstable equilibrium. If the application of any horizontal force neither raises nor lowers the center of gravity of the object, then the object is in neutral equilibrium. If the application of any force can raise the center of gravity but not lower it then the object is in stable equilibrium.

Several important concepts are illustrated by Figure 1. In, the top portion one of the six identical, stationary, steel balls

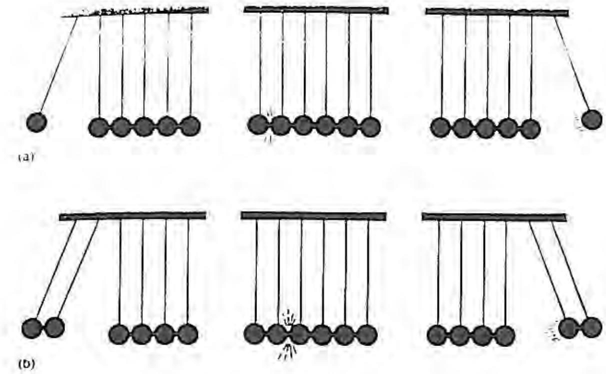

FIGURE 1

is pulled out and released. It swings in and strikes (interacts) with the left-hand stationary ball and the right-hand stationary ball swings out in response. Why not two balls or three or more? The answer is that the interaction is "perfectly elastic" and consequently both the momentum and the kinetic energy of the system are conserved. When one modifies this process by pulling out two balls, two stationary balls swing out in response (bottom portion).

Linear momentum is the product of mass and linear velocity. The total linear momentum of the system (six steel balls) before interaction is equal to the total linear momentum of the system after interaction. This is true whether or not the interaction is perfectly elastic. If two balls were to swing out when one ball was released, then their total mass is twice that of the ball on the left, and to conserve momentum their initial speeds must be half that of the ball on the left. However, if this happened then kinetic energy would not be conserved.

Translational kinetic energy is the product of one-half the mass and the square of the velocity. The total translational kinetic energy of the system before interaction is equal to the total translational kinetic energy of the system after interaction. When this is true the system interaction is said to be perfectly elastic. If two balls were to swing out when one ball was released, then the combined translational kinetic energies of the two balls would be half that of the ball on the left.

Momentum and kinetic energy are said to have been transferred. What has been transferred is energy.

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UPDATING THE FOUR BASIC TYPES

by Ralph R. Gregory, D.C.

BACKGROUND INFORMATION

Classification of the C1 subluxation was first introduced in the 1976 Annual NUCCA Convention. During the years that followed, a gradual emerging of the four basic types occurred as upper cervical X-rays were examined utilizing the orientation planes of motion as a reference (Fig. 1).

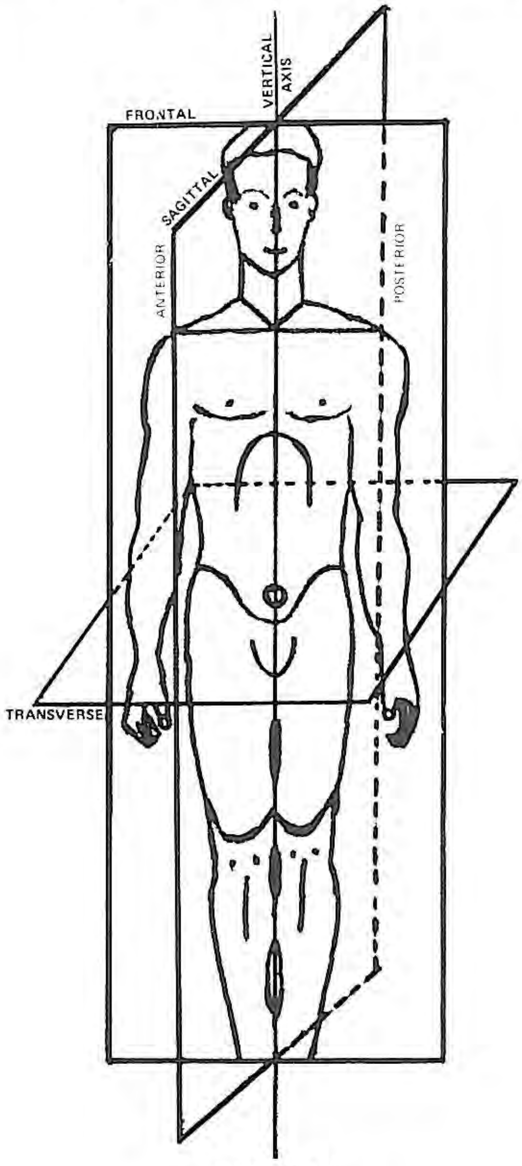


FIGURE 1
BODY PLANES

The study of joint motion, abnormal as well as normal, is clarified by reference to the orientation planes and the axes about which motion takes place, permitting of description, location, and, in general, better understanding.

A brief review of the Body Planes, sufficient for our purposes, follows: Three planes of motion, corresponding to the three dimensions in space, pass through the human body. Motion takes place in these planes and about the axes that are located at the intersection of any two planes.

The three planes of motion are (1) the anteroposterior or sagittal which divides the body in halves from front to back; (2) the frontal or lateral which divides the body equally from side to side, and (3) the transverse plane (horizontal) which divides the body into upper and lower halves.

The three axes of motion are (1) the vertical axis which is perpendicular to the ground; (2) the frontal or lateral which passes horizontally from side to side, and (3) the sagittal (anteroposterior) which passes horizontally from front to back.

Vertebrae that are aligned to the vertical axis execute normal motion whereas vertebrae whose centers of motion have deviated from the vertical axis execute abnormal or eccentric motion. The latter are the misaligned or subluxated vertebrae.

The vertical axis is the Z coordinate of the orientation planes, and is formed by the intersection of the frontal and sagittal planes. It runs perpendicularly from above downward.[1] The vertical axis is frequently referred to as the "line of symmetry" and the "gravital line". Wells and Luttgen (1976) state "since each of the orientation planes bisect the body, it follows that each plane must pass through the center of gravity. Hence the center of gravity may be defined as the point at which the three planes of the body intersect one another, and the line of gravity as the vertical line at which the two vertical planes intersect each other".[2] The vertical axis, then, is a line where all points correspond in size, form, and arrangement on opposite sides.

A vertical axis for the human body can be established in the perpendicular position from the center of the base of support or from the center of the sacrum. NUCCA practitioners draw the vertical axis for the cervical spine and skull perpendicularly on the nasium (A-P) from the center of the body of the first or second dorsal vertebra (Fig. 2). A triangular square is aligned with the base of the film so that its right-angled side passes through the cervical spine and skull from the center of the dorsal vertebra, and a line is inscribed upward through the skull. When the vertical axis line is compared with the angular rotation line, the film analyser can see the degree of excursion of the cervical spine and skull into one of the frontal planes. With the atlas subluxation complex corrected, the post nasium will show the cervical spine and skull restored to the vertical axis. Equilibrium is restored and the centers of motion of the vertebrae are aligned with the gravital line.

It became apparent as upper cervical films were analysed that they exhibited patterns that varied in character and would necessitate disparate means of adjusting according to the pattern. These patterns clearly were caused by gravitational stresses resulting from movements of the cervical vertebrae and skull into one of the frontal planes. As the excursion (angular rotation) of the cervical spine and skull took place, the cervical vertebrae became fixed, their axes of rotation displaced, and rotation of the cervical vertebrae subjacent to C2 into the transverse plane resulted.

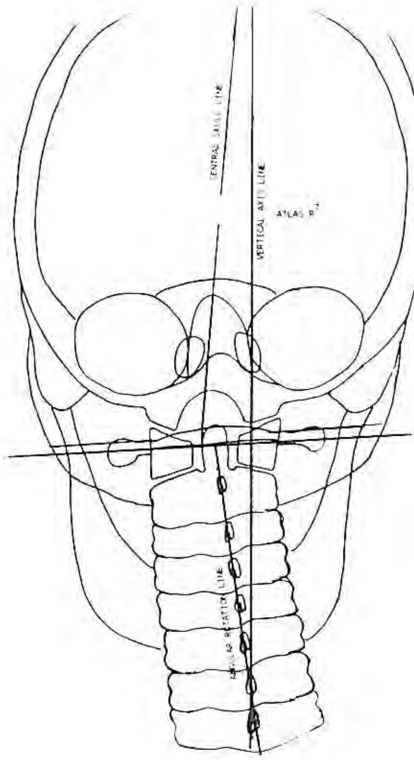


FIGURE 2
VERTICAL AXIS LINE

When an object or part of an object shifts its position, the center of gravity of the shifted part moves with it. When the cervical vertebrae and skull move into one of the two frontal planes and away from the vertical axis, the centers of gravity move in the same direction. This occurrence must precede the misalignment of the vertebrae which are an inherent and integral part of the subluxation.

Angular rotation or movement from the vertical axis into one of the frontal planes is, therefore, the first step in the production of the C1 subluxation complex. The concept that angular rotation is responsible for the vertebral rotations subjacent to C2 into the transverse plane is supported by basic type three. In basic type three no angular rotation is present, and the rotation of the vertebrae subjacent to C2 does not occur. Further evidence supporting this concept exists in the post x-ray in which the angular rotation is corrected, and vertebral rotation no longer exists.

Several vertebrae are involved in the atlas subluxation complex. Anatometer tests have shown that the entire spinal column is deviated from the vertical axis as the pelvis misaligns into the frontal and transverse planes as a consequence of the C1 subluxation.

All C1 subluxations are abnormal because they exist in an abnormal situation. That is to say, that there are no "normal highs", "normal lows", etc. The forces that produce the so-called "highs" and "lows" are themselves abnormally operating. The resistances that are offered by any type C1 subluxation, furthermore, are produced by vertebral and skull movements that are abnormal, not by vector relationships. All types of C1 subluxation reduce proportionately and easily if the vectors are computed correctly and the patient is efficiently adjusted according to the type he/she exhibits.

It is the purpose of this paper to examine each basic type subluxation, to identify the distinguishing characteristics of each basic type, and to discuss the placement of the patient on the headpiece for each type.

DISCUSSION OF THE FOUR BASIC TYPES

FIRST BASIC TYPE

The first basic type (Fig. 3) exhibits the following characteristics: Laterality of C1 is always on the side opposite angular rotation. Figure 3 shows a laterality of four degrees against an opposite lower angle formed by the excursion of the cervical spine and skull into the right frontal plane of the body.

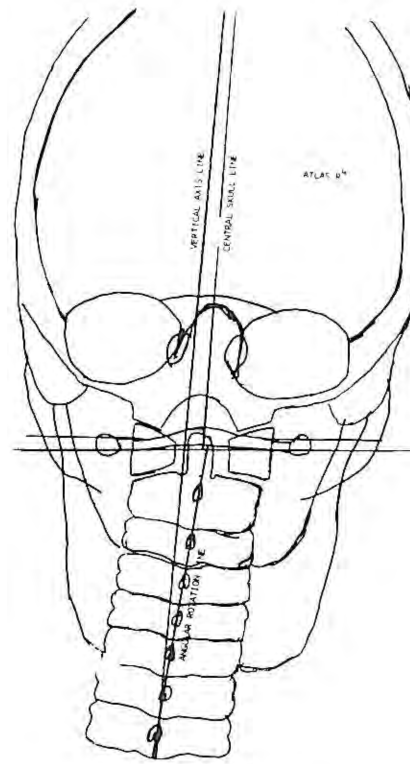


FIGURE 3
FIRST BASIC TYPE

The second characteristic of a first basic type is the position of the skull in relation to the vertical axis line. This comparison, as seen on Figure 3, indicates that the skull is turning out of the right frontal plane and toward the vertical axis because the lines tend to converge near the vertex of the skull. This is probably an adaptive process brought about by muscular action and the righting reflexes, which, if not active, would allow such an unstable situation that the system could collapse.

It is of further interest to note, that, characteristic of the first basic type, the skull position parallels the vertical axis or turns toward it. (In the third and fourth basic types, an exception exists in that the head turns away from the vertical axis). In the first basic type, however, when the skull parallels the vertical axis, rotation of C1 into the transverse plane highly favors an anterior rotation. If the skull turns toward the vertical axis, rotation of C1 in the transverse plane favors posteriority.

The influence of skull position in basic type one on C1 rotations into the transverse plane is thought to be due to the influence of skull gravity. The further the skull turns toward the vertical axis, the greater will be the displacement of the gravital line toward the occipital condyle opposite the side of C1 laterality. The axis of rotation, therefore, of C1 is at the condyle-lateral mass articulation opposite laterality which strongly tends to rotate C1 posterior.

A third characteristic of the first basic type is the plane of C1. From the normal horizontal plane, C1 moves higher, sometimes approximating an inch or more. With the skull in normal position or turned away from the side of C1 laterality, the higher plane of C1 would indicate that C1 has moved laterally on the condyles of occiput as opposed to the skull turning on the occipital condyles and producing laterality of C1.

The amount of excursion of the cervical spine and skull into one of the frontal planes generally varies from one degree to eight or nine degrees. A few excursions of greater magnitude have been observed up to and including fourteen degrees. The greater the amount of the cervical and skull excursion, the greater the displacement of skull gravity to the side opposite laterality. The more, therefore, that the skull turns toward the vertical axis in type one, the larger may be the posterior rotation of C1 into the transverse plane.

The fourth characteristics of basic type one is that the body of C2 may misalign further to the side of laterality than C1. These rare cases, of course, must be extremely angulated into one of the frontal planes.

Two factors determine the amount of rotation into the transverse plane of vertebrae subjacent to C2: Rotation of C2 (spinous position) and angular rotation. When taking a nasium x-ray film where the patient is properly placed and the equipment is in alignment, the angular rotation line in the majority of cases will bisect the spinous process of the seventh cervical. The degree of rotation of C2 also determines the pattern which the spinouses of subjacent vertebrae assume. If the spinouses are rotated considerably, C2 will be rotated excessively. Angular rotation, however, modifies the pattern of rotation. The fact that the angular rotation line bisects the lower cervical indicates the dual relationship of both factors.

When a patient of the first basic type is placed for the adjustment, certain precautions must be observed so that a maximum reduction is obtained by the adjustment. The skull center of gravity must rest directly over the mastoid support of the headpiece, preferably the lower edge of the mastoid piece. The center of gravity of the balanced human skull is approximately 30mm above the external auditory meatus (Fig. 4). By positioning the patient's head in this manner when adjusting a first basic type, the head will move slightly downward about its center of gravity bringing the foramen magnum in line with the vertical axis, and aiding in

FIGURE 4
SKULL CENTER OF GRAVITY

returning the angular rotation to the vertical axis. The parietal end of the headpiece should be slanted slightly so that there is no interference with the vertex of the skull.

(Figure 5 shows the correct position of the patient's head for the first type, placed for the adjustment).

Adjusting a first basic type requires a rather rapid movement of the skull about its center of gravity because the head must be turned toward the vertical axis and C1 moved down and around the superior articulating surfaces of C2. Before C1 can align to the condyles of occiput, it must first move about the superior articulating surfaces of C2. C2 is the base of support for C1 and the skull. Because in type one laterality of C1 is caused by C1 turning on the condyles of occiput as opposed to the skull turning on the superior surfaces of C1 as in other basic types, it is essential to maximum correction that the C2 base of support be moved slightly ahead of C1.

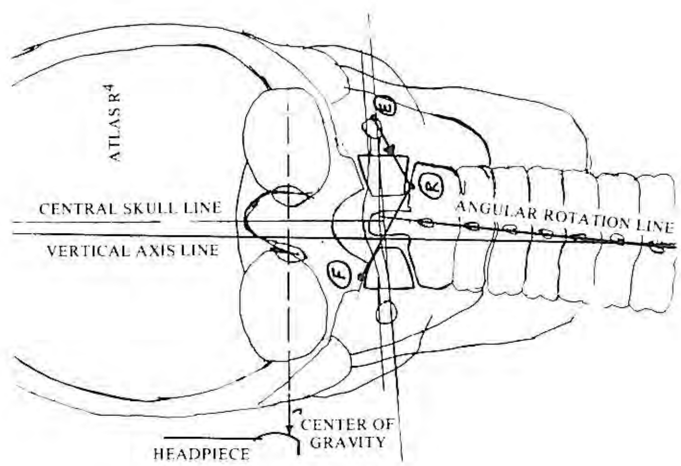


FIGURE 5
FIRST BASIC TYPE
POSITIONED ON HEADPIECE
SECOND CLASS LEVER

C1 laterality is related to angular rotation. To the degree that angular rotation is restored to the vertical axis, C1 laterality is reduced.

Resistances that must be overcome in the first basic type are primarily the angular rotation into the frontal plane, the size of the superior articulating surfaces of C2, and the degree of the rotation of the cervical vertebrae below C2. The size of C1 laterality is **not** a true resistance because its reduction depends upon the successful restoration of the angular rotation and the movement of C1 about the superior articulating surfaces of C2. To the degree that angular rotation corrects, C1 laterality corrects proportionately.

The plane of C1 does not constitute a true resistance because its correction depends on the restoration of angular rotation to the vertical axis.

SECOND BASIC TYPE

Placing the patient on the headpiece for a basic type two (Fig. 6) requires a procedure quite different from the basic type one. Figure 7 indicates the relationship of the mastoid process (S) to the mastoid support of the headpiece. The parietal end of the headpiece should be lowered to allow the vertex of the skull to turn downward in the adjustment. The head is placed in a position so that the mastoid support contacts the skull at the mastoid well below its center of gravity so that the upward reactive force from the headpiece turns the skull toward the vertical axis.

In the second basic type subluxation, the turning of the skull from the vertical axis causes most of the subluxation of C1. The head turns inward on the side of C1 laterality, creating the acuteness of the angle between the central skull line of the skull and the plane of C1.

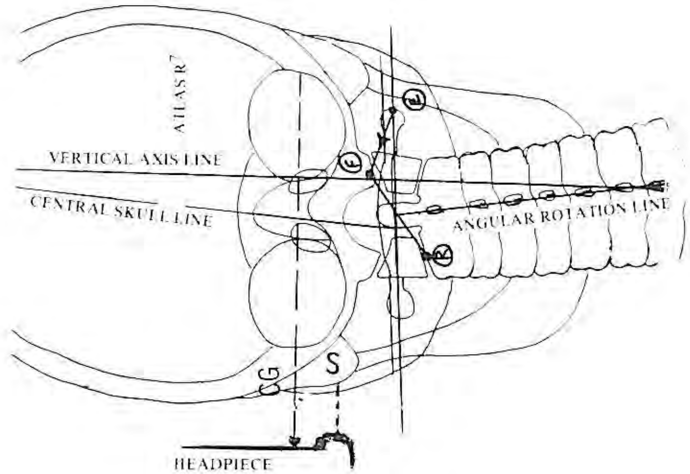


FIGURE 7
SECOND BASIC TYPE
POSITIONED ON HEADPIECE
FIRST CLASS LEVER

Angular rotation is restored to the vertical axis when the adjustic force rotates C1 up and around the superior articulating surfaces of C2, bringing the odontoid process of C2 back to the vertical axis. Rotations of C2 are corrected by utilizing torque in the adjustment. Torque cannot be ignored. Increasing the height vector as a substitute for torque in basic type two increases the angular rotation, increasing disequilibrium.

In the second basic type, the plane of C1 is usually horizontal or slightly low on the side of C1 laterality. A few cases, however, exhibit an elevation of the plane of C1 from the horizontal. In these cases the height vector must be kept low in order to turn the head toward the vertical axis. To correct the position of the C1 plane back to the horizontal, it is necessary to adjust the patient several times on the first visit. Using several adjustments while adjusting with a lowered vector returns the skull to the vertical axis and positions the plane of C1 by the adjustic force against the condyle of occiput on the side of laterality.

A rule of thumb in dropping height vectors on all cases requiring a lowered vector is to decrease the vector by two inches. If C1 laterality is numerically small, a competent adjuster can drop the vector by two or even three inches.

Resistances that must be overcome when adjusting a second basic type are the turning of the skull back to the vertical axis and aligning the superior articulating surfaces of C2 back to the vertical axis. Plane lines and angular rotations are not primary resistances because they normalize if the skull and C2 are restored to the vertical axis. As in all the basic types, the size of the articulatory surfaces of C2 is a primary resistance factor. The larger the circumference, the greater the resistance.

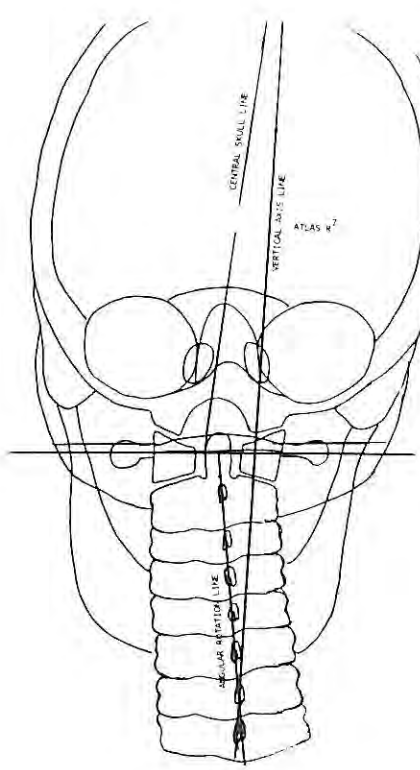


FIGURE 6
SECOND BASIC TYPE

THIRD BASIC TYPE

Placing the patient for the adjustment for the third basic type (Fig. 8) is substantially the same as for basic type two (see Fig. 7). The parietal end of the headpiece is lowered to remove any obstruction to the head turning in the adjustment.

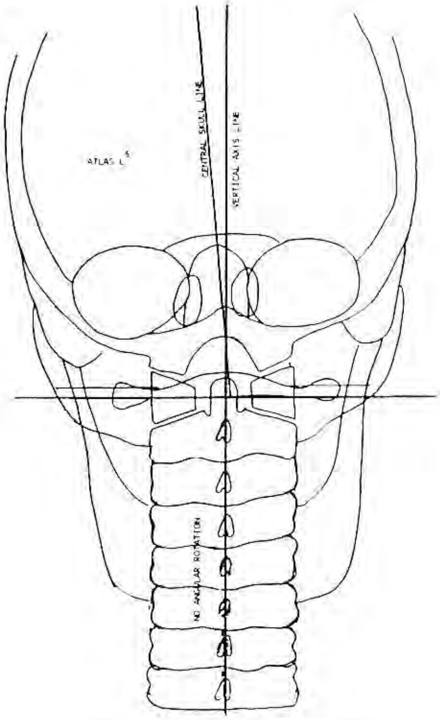


FIGURE 8
THIRD BASIC TYPE

Distinguishing features of this type are: head turned away from the vertical axis to the side of the C1 subluxation; plane of C1 generally nearly horizontal, and no angular rotation beacuse the cervical spine has not moved into a frontal plane; it is the skull that has moved into a frontal plane, producing the C1 subluxation. The most distinguishing feature is that the vertebrae subjacent to C2 have not rotated and their centers of motion remain on the vertical axis.

When adjusting type three, the height vector should be lowered about two inches so that the skull moves back to the vertical axis from a lowered adjustic force. The adjustic force should be directed up and around the superior articulating surfaces of C2. In cases of small numerical lateralities of C1, the vector may be lowered another inch. C1 laterality is corrected when the skull is returned to the vertical axis.

Resistances to the adjustment in basic type three are the skull and the superior articulating surfaces of C2.

FOURTH BASIC TYPE

Basic type four (Fig. 9) is a combination of types one and two. The C1 subluxation exists in the same frontal plane as that into which the cervical spine has moved, as in basic type one. (In basic type two the C1 subluxation occurs in the opposite frontal plane).

In basic type four the patient is placed as in basic types two and three, using a mastoid contact on the mastoid

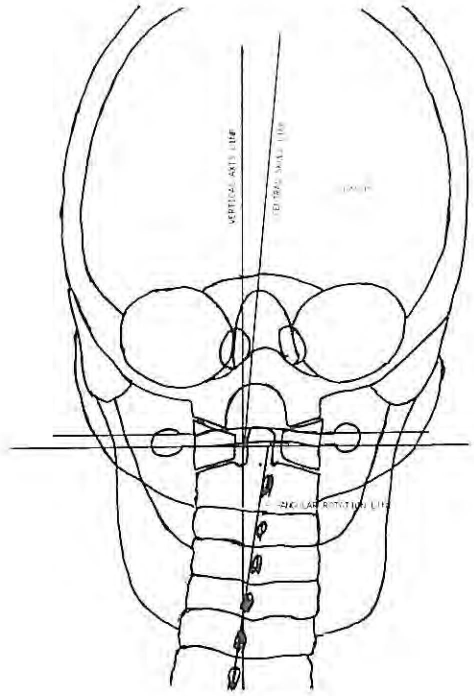


FIGURE 9
FOURTH BASIC TYPE

support (Fig. 7). The parietal end of the headpiece is lowered to remove interference with the skull turning to the vertical axis.

The distinguishing characteristics of a basic type four are that the head is turned away from the vertical axis and is producing some is not all of the C1 subluxation. Angular rotation, however, is opposite the side of C1 laterality as is the case in a basic type one.

The height vector can be lowered about two inches. In this type case the head must be turned upward toward the vertical axis, but the adjustic force must go down and around the superior articulating surfaces of C2 in order to correct angular rotation. Lowering the vector too much can increase angular rotation.

Resistances in the fourth basic type are the skull and the articulating surfaces of C2.

CONCLUSION

This paper discusses the four basic type subluxations. All findings are based on the efficient performance of the manual triceps contraction adjustment. The adjustor's understanding of proper headpiece placement for each type and the direction of adjustic forces against the primary subluxation resistances aids in obtaining maximum reductions. Improper patient placement can produce increased misalignments and greater disequilibrium in the subluxation system. The fourth basic type is generally a result of improper headpiece placement.

References:

[1]Steindler, Arthur: Kinesiology of the Human Body, Fifth printing, pp 11, Charles C. Thomas Company, Springfield, Illinois, 1977.

[2]Wells, K. F. & Luttgens, K.: Kinesiology, Scientific Basis of Human Motion. 6th Ed., pp 20, Saunders College Publishing, Philadelphia, 1976.

Overcoming C1 Subluxation Resistance

by Ralph R. Gregory, D.C.

When the triceps brachii muscles are pulled bilaterally from their insertion in the olecronon processes to the muscles' origins in the infraglenoid tuberosities of the scapulae, the shoulder girdle of the adjuster compresses and his episternal notch extends. The muscular action is reinforced by locking the adjuster's hands together in the roll-in.

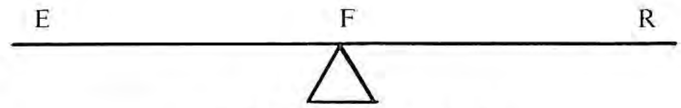
This adjustic action is a first class lever, the triceps brachii constitute the effort, the shoulder girdle the resistance, and the glenoid cavities are the fulcra (Figure 1).

Pulling the triceps from insertion to origin rather than from origin to insertion is an example of the kinesiological concept of functional reversibility (Figure 2).

The resistances offered by the misalignment factors of the C1 subluxation complex are surmounted and the subluxation adjusted (corrected) when the shoulder lever—the resistance of the first class lever—compresses to a point equal to the degree of resistance offered by the subluxation. If, for example, 12 pounds of force is required to overcome the resistances of the misalignments of the subluxation, compression of the adjuster's shoulder girdle resulting from the triceps contraction equal to 12 pounds will restore the vertebrae and skull.

Depth and excessive force that could produce a greater subluxation is eliminated. Equating depth and excessive force in an adjustment with better correction of the subluxation is erroneous. Depth produces buckling of the cervical spine at the superior articulations of C2, and an adjustic force into the patient's neck that is greater than the resistance of the subluxation causes greater subluxation. Excessive adjustic force will also turn the patient's head from the vertical axis of the body, causing greater misalignment between C1 and the foramen magnum of the occiput.

The purpose of the triceps pull, then, is to initiate the adjustic force, control the size and extent of the force, and to activate the largest lever (shoulder) first.



FIRST CLASS LEVER
E (Effort): Triceps brachii contraction
F (Fulcrum): Shoulder joint axis of motion
R (Resistance): Shoulder girdle.
FIGURE 1

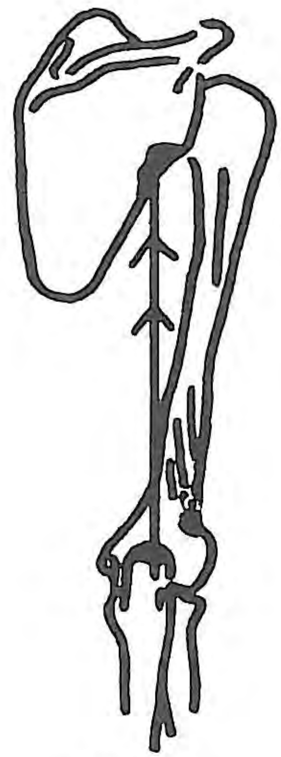


FIGURE 2
LINE OF PULL

Announcement

Dr. AnneMarie Sheppard recently announced the opening of her family practice in San Diego, California. She will practice at the Precision Chiropractic Center.

Dr. Sheppard returned to her native California after practicing with Dr. M. Wayne Clark in Oklahoma for the first year.

A 1983 graduate of Life Chiropractic College West, Dr. Sheppard received the College's prestigious first annual Clinical Excellence Award. She also has obtained the Certificate of Achievement from the Erhardt Proficiency Program.

Dr. Sheppard is a member of NUCCA, ACA, and ICA.

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.

The Ruth O. Gregory Memorial Fund

To the many and generous contributors to the RUTH O. GREGORY MEMORIAL FUND, NUCCRA extends its heartfelt thanks. Your contributions to the Fund have helped to finance C1 subluxation research, advance your profession, and assist our colleagues to practice subluxation-reduction, thereby helping your profession, your patients, and yourselves.

The NUCCRA Directive Board in November of 1982 unanimously voted to establish a Memorial Fund as a tribute to Ruth O. Gregory in appreciation for the time and effort which she so selflessly gave to the NUCCA-NUCCRA Organizations. The Fund is to exist as long as the Organizations exist. It was her great desire that chiropractic become more scientific, and of greater benefit to mankind. She saw bona fide research as the only way to achieve these goals. To this end, she devoted time, effort, and money.

Since her death in June of 1982, many donations have been received from doctors, students, and lay persons who knew her. These donations have been used for the sole purpose of furthering NUCCRA research.

It is the feeling of the NUCCRA Directive Board that, through this Memorial Fund, Ruth O. Gregory's great interest in the development of chiropractic will live on, and the advancement of chiropractic continue to the benefit of all.

Recent donators to the Ruth O. Gregory Memorial Fund are:

Mr. Bert Kizer	Illinois
Mr. J. P. McNerney	Ohio
Dr. B. Bussanich	Oregon
Mrs. Caroline Galor	Connecticut
Dr. S. Schroder	Oklahoma
Mrs. Marynelle Shields	Indiana
Mr. John Savage	Ohio
Dr. & Mrs. Marshall Dickholtz, Sr.	Illinois
Mrs. B. Nadeau	Connecticut
Dr. T. Pranaitis	Colorado
Dr. D. Fedeli	Illinois
Mr. D. A. Miller	Michigan
Dr. K. Nakano	California
Dr. D. Juszczyk	Ohio
Dr. Donald K. Moon	Ohio
Dr. Kent Fox	Ohio
Dr. & Mrs. M. Wayne Clark	Oklahoma
Jason Bean	Oklahoma
Dr. Brian O'brien	Hawaii
Dr. Robert T. Brooks	Oklahoma
Dr. Albert A. Berti	Canada
Dr. R. R. Gregory	Michigan

In Memoriam

Dr. Lewis Herbert McLellan

(September 19, 1892 - April 14, 1984)

The death of Dr. Lewis Herbert McLellan on April 14, 1984 marked the close of an outstanding chiropractic career. Over 90 years of age, this dedicated doctor continued to practice his profession until hospitalized for a stroke on March 8, 1984, an active practice span of 60 years.

Lewis Herbert McLellan was born September 19, 1892 in Barron County, Wisconsin, the eldest of six brothers and six sisters. Employed in his early years as a surveyor and later as an engineer by the Wisconsin Highway Commission, he became interested in chiropractic after becoming a patient during the 1918 influenza epidemic.

In 1921, Lewis McLellan enrolled in the Palmer College of Chiropractic in Davenport, Iowa. Receiving his degree, he returned to Arizona, opening a practice in Jerome, later moving to Mesa.

Shortly, Dr. McLellan went to California to join the faculty at the Ratledge College of Chiropractic in Los Angeles where he established the College's first X-Ray Department. It was at the Ratledge College where Dr. "Mac," as he was to become known throughout the profession, became interested in upper cervical chiropractic after hearing Dr. B. J. Palmer lecture. Upper cervical became Dr. McLellan's specialty, and he practiced it throughout his long career.

Returning to private practice in San Jose, California, Dr. "Mac" became treasurer of the Chiropractic League of California. He also served as assemblyman for the International Chiropractors Association, and was a charter member of the Palmer Standardized Chiropractic Council. Frequently called upon to testify on chiropractic, Dr. "Mac" was an expert witness in several "milestone" cases, including the famous McGranaham case.

Called back to his favorite State of Arizona for business reasons, Dr. McLellan opened a practice in Mesa, where he continued to serve as an assemblyman for the International Chiropractors Association. He was also appointed to the Arizona Board of Chiropractic Examiners where he served for six years.

Always searching to improve his practice methods in upper cervical, Dr. McLellan attended his first seminar in the Grostic technique in 1949 in Ann Arbor, Michigan. He continued attending these seminars until Dr. Grostic's untimely death in 1964. Since 1964, Dr. McLellan affiliated himself with the research work of Dr. Ralph R. Gregory of Monroe, Michigan, which was later to become the NUCCA-NUCCRA Organizations. He was a member and supporter of the NUCCA-NUCCRA Organizations, attending nearly every convention and seminar, until his death.

A leader, a teacher, and a fighter for his profession, this chiropractic pioneer has left us. In our memories, however, he will always remain, an example to emulate, and a professional dedication to equal. We will miss him, and to his wife, Veda, his daughter, Shirley, and his sisters, Madge, Inez and Nina, we express our heartfelt sympathies.

McLellan Memorial Fund

A Memorial Fund has been established for those doctors who wish to "bestow a tribute to one of the greats of our profession"; one who has helped to make the way easier for today's chiropractor who now can enjoy the fruits of the strenuous labors of chiropractors like Dr. Lewis Herbert McLellan of Arizona. Dr. McLellan passed away on April 14, 1984 after over 60 years in active practice, and political activity for the advancement of chiropractic.

Donators to the McLellan Memorial Fund are:

Dr. George Anderson	California
Dr. George Wentland	California
Drs. Kemper & Powers	California
Drs. J. C. & L. C. Downes	California
Dr. I. Adamczuk	New York
Dr. R. L. Wiedemann	Wisconsin
Dr. Ralph R. Gregory	Michigan
Dr. Keith E. Denton	Michigan

Those doctors who wish to donate to the memory of Dr. McLellan should send their checks to NUCCRA, 217 West Second Street, Monroe, Michigan 48161. Checks should be made out to NUCCRA—McLellan Memorial Fund.

The Eighteenth Annual NUCCA Convention

The 1984 Annual NUCCA Convention and Educational Conference was held at the Howard Johnson Motor Lodge in Monroe, Michigan from Saturday, May 5th through Tuesday, May 8th. The convention room was, as usual, filled to its capacity.

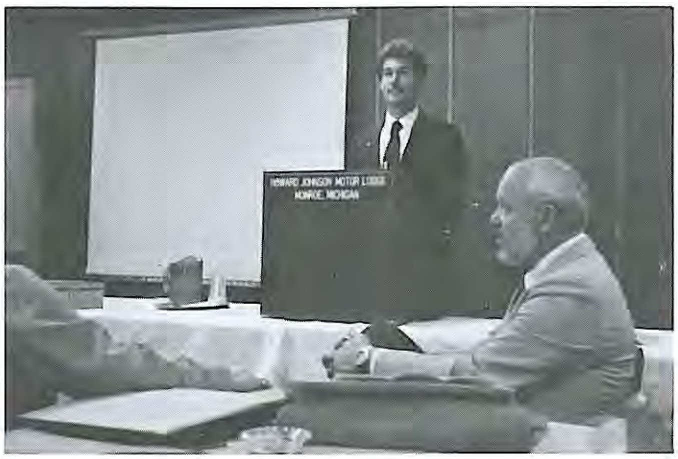
Dr. Glenn Cripe, Convention Chairman, from California opened the educational proceedings which were supervised by Daniel C. Seemann, Ph.D. from The University of Toledo. Dr. Seemann was assisted by Drs. Teresa A. Palmer, Keith Denton, Albert A. Berti, Lloyd Pond, and R. R. Gregory.

The educational program was a "hands on" program. Doctors and students were divided into categories corresponding to the subjects taught: X-ray analysis, leg-checking exercises, adjusting exercises, adjusting problems, biomechanical problems, etc. Solutions to the exercises and problems were compared to school solutions.

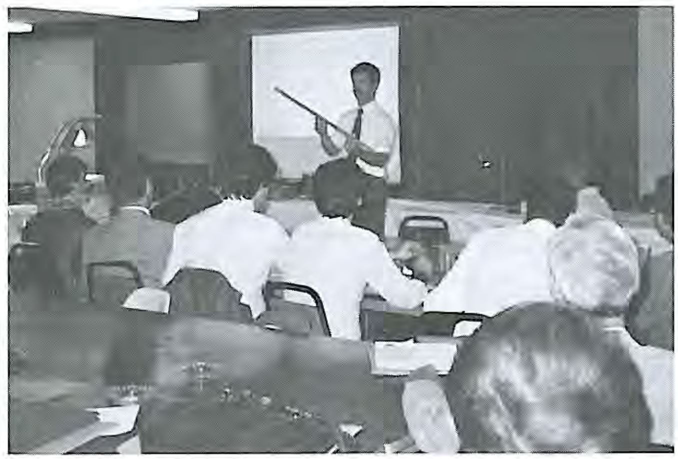
Previously prepared videotapes from the NUCCA Library were shown. Several participants were videotaped performing adjusting exercises, using the video as a learning tool, so they could see themselves adjusting and view their errors.

Highlights of the educational conference were the presentations by James F. Palmer, M.S., and Daniel C. Seemann, Ph.D., both from The University of Toledo. Mr. Palmer addressed the convention on *Some Physics of the C1 Adjustment*, and Dr. Seemann discussed ongoing NUCCRA research regarding newer findings in upper cervical biomechanics. Articles on both these subjects appear in this *Monograph*.

The Educational Conference was co-sponsored by The University of Toledo.



Dr. Glenn Cripe, Chairman Convention



Mr. James F. Palmer, M.S., The University of Toledo

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. 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 specimen.

Leg Check and *Headpiece Placement* (45 min.) .... $ 90.00
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