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Mechanical and Manual Adjusting: A Comparison

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The increasing use of adjusting machines to produce a force intended to correct a C1 subluxation complex raises the question of the relative merits of the mechanical method compared to hand adjusting. This paper discusses this question based on data from the research findings of the National Upper Cervical Chiropractic Research Association, Inc. (NUCCRA), an *Analysis of a Chiropractor's Data,* Geoffrey K. Aldis and James N. Hill, Department of Mathematics, The University of Wollongong, Wollongong, New South Wales, Australia, and *Research and Development of the Specific Adjusting Machine (SAM),* Arden D. Zimmerman, San Jose, California.

THE PROBLEM:

Adjusting a C1 subluxation complex, either manually or mechanically, requires the restoration of the abnormal movements of the vertebrae comprising the complex to their normal position. Webster defines the word adjustment to mean "the bringing of a thing or things into proper or exact position or condition; arrangement. . . ." It is therefore, essential to first compute from the x-rays a straight-line resultant of the corrective forces. This resultant is the vectorial sum of the abnormal movements of the vertebrae; the carrier of the force which if aligned to the resultant will restore the malpositioned vertebrae to normal position. It is the subluxation's reduction pathway, and is also referred to as the notch-transverse resultant.

Regardless of the system used—manual or mechanical—establishing a reduction pathway for each C1 subluxation complex is the first step in correcting malpositioned vertebrae. The length, direction, and magnitude of the adjustic force along the reduction pathway are pre-conditions to the restoration of misaligned vertebrae of the upper cervical spine, exactly as these elements are essential when moving any structure from one position to another. Because the vertebral subluxation cannot exist in the absence of some degree of abnormal vertebral movement, adjustic correction of the subluxation's misalignments is imperative.

How much correction is required to obtain a high degree of patient results? In a 1976 study[1] by Daniel C. Seemann, Ph.D., NUCCRA Research Director, the hypothesis that a patient's prognosis is best when the subluxation's misalignments are reduced by 80% or better was analysed. The hypothesis was found to be true. A random sample of 200 case findings were taken from a chiropractor's file of over 2,000 patients. A comparison between the 80%, 70% and 60% levels of reduction showed little difference in patient results between the 80% and

(Continued on page 2)

Geometric Factors in Radiology

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The quality of a radiograph is equated with the visibility of relevant details. The measurement and interpretation of the details are among the first steps performed by the practicing chiropractor.

The visibility of details is a function of radiographic contrast and sharpness. Radiographic contrast and sharpness are completely independent physical factors. Radiographic contrast is the difference in "darkness" (optical density) between the image of the object and its surroundings. Sharpness or definition is concerned with the boundary between the image of the object and the surrounding area.

Sharpness is a function of geometric factors and radiographic mottle. This article is concerned with some of the geometric factors affecting sharpness- focal spot size, source-film distance, and object -film distance.

The diagrams that are contained within this article as well as most of the discussion were taken from "The Correlated Lecture Laboratory Series in

(Continued on page 6)

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Mechanical and Manual Adjusting *(Continued from page 1)*

70% levels (1.5%) but a considerable loss between the 60% and the 70%/80% levels (16.3% and 17.8%).

Table 2 shows the incidence of patients having satisfactory results with an 80% reduction of the misalignment factors. 138 patients of the 200 had better than an 80% reduction and of the 138, 11 did not have satisfactory results. In 4 of the 11 cases, the results were unknown. Of the 62 patients who did not receive an 80% reduction, only 20 had a good prognosis while 42 had unsatisfactory results.

TABLE II

PATIENTS HAVING SATISFACTORY RESULTS WITH AN 80% REDUCTION

	GOOD	FAIR	POOR	UNKNOWN	TOTAL
80 + Above	126	4	1	5	136
79 + Below	20	19	22	3	64
Total	146	23	23	8	200

Table 3 shows the incidence of patients having satisfactory results in a range of reduction from 40% to 100%. The Seemann findings clearly indicate that a high percentage of vertebral misalignment correction is essential if good patient response is to be expected, and chiropractic is to be of any value to the public.

TABLE III

PATIENTS HAVING SATISFACTORY RESULTS— FROM 40% TO 100% REDUCTION

Reduction Percentage	GOOD	FAIR	POOR	UN-KNOWN	TOTAL
95-100	76		1	2	79
90-94	19	1			20
85-89	19	1		2	22
80-84	12	2		1	15
75-79	7	1			8
70-74	7		2		9
65-69	5	10	2		17
60-64		6	1		7
55-59		1	2	3	6
50-54	1	1	5		7
45-below			10		10
TOTAL	146	23	23	8	200

The basic findings from hypothesis #2 show that usually the greater reduction of subluxation (misalignment factors) the better the prognosis for the patient. With the information found in Table 3 the cut-off point can be revised to 70% instead of the 80%. This article does not suggest that the adjuster strive for 70% reductions. It suggests that the adjuster is on shaky grounds if his adjusting pattern seems to hover around 70% reductions. As Table 4 suggests, to get satisfactory results the adjuster should be getting at least 90% reductions.

TABLE IV

SUMMARY OF MEANS AND STANDARD DEVIATIONS FOR THE CLASSIFICATIONS GOOD, FAIR, AND POOR WITH REGARD TO THE REDUCTION OF THE MISALIGNMENT

Classification	MEAN	S.D.
GOOD	92%	4.12
FAIR	69%	9.38
POOR	50%	18.19

The problem that faces the manual and the mechanical adjuster is, then, which system more efficiently restores the C1 subluxation complex, the vertebral misalignments to normal position. The answer to the problem is found and verified by post x-ray, patient response, and the anatometer, an instrument that measures spine and pelvic distortions before and after the adjustment.

Years of anatometer studies correlating spinal column distortions and their reductions to the C1 subluxation and its reduction also clearly show the necessity of a maximum correction in obtaining patient response.

DISCUSSION

It has been argued that it is virtually impossible for the human body to deliver a rectilinear force.[2] NUCCRA's findings refute this notion and clearly show that the human body is capable of delivering a rectilinear force provided that the adjuster's understanding and performance of the adjustic act are consistent with relevant kinesiological and mechanical principles. The notion seems, however, to be widely accepted, and is apparently based on the fact that an adjusting machine is more accurate simply because it is mechanically designed to deliver a rectilinear force.

When comparing the mechanically produced adjustic force with the manually delivered force, many factors should be considered. Not the least of these is feedback, perception by the adjuster that the C1 vertebra is moving along the prescribed reduction pathway and successfully overcoming the resistances set up by the superior articulating surfaces of C2 and the subjacent cervical vertebrae. The NUCCA manual adjuster is conscious of the C1 vertebra moving, and the ease with which it moves tells him of the accuracy of his force. Both the adjuster and the patient hear the vertebra move. Feedback cannot be obtained with a machine adjustment.

Another very important factor is the adjuster's control of his force. The magnitude of force necessary to correct a C1 vertebral complex is determined in each case by the resistance offered by the size and malposition of the C2 vertebra, the malpositions of the posterior cervical articulations, and associated structures. The adjustic force should not greatly exceed the C1 subluxation's resistances because, if it does, trauma can result, the subluxation can increase, and a different type subluxation may result.

The notion that force and depth are conducive to C1 laterality reduction is erroneous. The opposite proves true: that control, accuracy, and very little depth most efficiently correct C1 subluxations. Post x-rays of thousands of cases of all types provide abundant data showing that a C1 reduction is accomplished easily and more completely when force and depth are controlled.

A mechanically produced adjustic force equates depth with force: the greater the force, the deeper the thrust. Dr. Arden D. Zimmerman[3] states on page 6 of his booklet on his adjusting machine that "the general idea is to use more thrust with thicker, more muscular necks and likewise more depth. Less depth is a general consideration for lighter, less muscular necks. For example, the 20 inch neck of a wrestler requires the maximum thrust of 105 pounds and three-quarters of an inch depth. By comparison, a very small child needs only 20 pounds thrust and one-fourth inch depth."

The NUCCA-trained manual adjuster utilizes his adjustic force primarily to overcome the resistance of his largest bodily lever, the shoulder girdle. The force, then, is not directed into the patient's neck for the purpose of moving vertebrae. In this manner, the adjuster can control his adjustic force and depth and because the vertebrae move when the exact required force needed to overcome the resistance of the adjuster's shoulder girdle is achieved. No greater force enters the patient's neck than that required to overcome the vertebral resistances. The magnitude of the force rarely exceeds 20 to 25 pounds with a less than one-eighth inch depth. It is the expression of the force generated by the triceps contraction compressing the adjuster's shoulder girdle that moves the vertebrae. The size of the patient does not determine the amount of force required. It is the subjacent vertebral resistances that dictate the magnitude of force.

When a NUCCA practitioner adjusts the Atlas Subluxation Complex, C1 is used as a lever with which to align C1 to the occipital condyles, bring the skull to the vertical axis (normal), and reposition the subjacent cervical vertebrae. The lever system can, therefore, be used to determine the required force to reposition C1. Seemann states[4] that it is possible to determine the amount of force required to move the atlas either up and around the condylar circle (condyles of occiput) or down and around the axial circle (superior articulating surfaces of C2). The formula from physics for levers is: the counter clockwise component must equal the clockwise component, i.e., the distance from the fulcrum X the resistance must equal the distance from the fulcrum X effort (Miller, 1977). With the first class lever, assuming the rod is a distance of one, the length of the distance between (R) and (F) can be set arbitrarily at 2/3 and the distance between (F) and (E) at 1/3. The theoretical amount of effort required to move the resistances then can be calculated. (See figure 8.) For a first class lever the effort required to move the resistance would be 2R. The second class lever requires less effort to move the resistance, again refer to figure 8, the effort required to move the resistance is 2/3R.

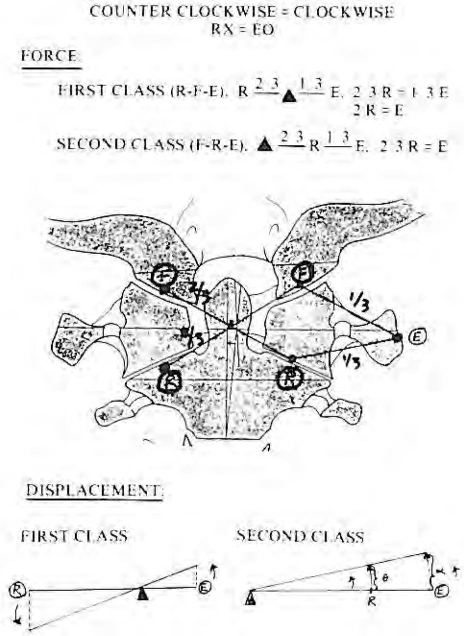

Fig. 8
Force and Displacement

NUCCA post x-rays in which less than 20 pounds of force and less than one-eighth inch depth were used show a 90% to 100% correction. A degree of lateral movement of C1 on the occipital condyles is about the thickness of a sharp pencil line. Few lateral movements of C1 exceed 5 degrees, roughly one-quarter of an inch in linear measurement. Why, then, the need for great force and depth? Even when the lateral movement of C1 exceeded 5 degrees, increased depth and force failed to aid in obtaining a better reduction.

Force is the capacity to do work or cause physical change; it is the expression of power against resistance. The greater the resistance, the more need for increased power. Power, however, causes depth, the downward dimension in the adjustment, and depth inhibits subluxation reduction because it tends to move the skull in the direction of the thrust, overcoming its resistance thereby moving the occipital condyles away from the desired movement of C1. In a mechanically produced force, depth increases as force increases.

In basic type one subluxations in which the cervical angulation is opposite to the side of C1 laterality, and is considerable, a greater adjustic force is necessary to overcome the greater resistance presented by the opposite lower angle. Although the adjustic force and depth can be controlled by the triceps contracting the shoulder girdle, follow-through greatly aids in overcoming large resistances to the C1 adjustment.

Follow-through in the C1 adjustment is a continuation of the momentum generated by the triceps muscles as they overcome the inertia of the adjuster's body. Activation of the adjuster's shoulder girdle transfers the momentum to his body and "pulls" him along the reduction pathway to the extent to which his adjustic action lines move the same distance coplanar with the reduction pathway at the same time. Follow-through results from completion of the triceps contraction; it is not a "body-drop" which precedes the completion of the adjustment and shortens the length of the reduction pathway, inhibiting subluxation reduction.

Follow-through cannot be initiated by an adjusting machine which must increase force and depth in proportion to an increase in C1 resistance.

Torque in the C1 motor skill is for the purpose of restoring C2 spinous rotation to the vertical axis. Machine devices that do not incorporate torque have advocates who deny the essentiality of employing the torque mechanism in the adjustment. While it is true that a C2 spinous rotation of two or three degrees will correct if the height vector is sufficient, C2 spinous rotations of five, ten, or fifteen degrees do not correct unless torque is exercised in the C1 adjustment. This is proved by post x-rays.

Additionally, in many cases of the second and third basic type C1 subluxations in which the height vector must be lowered to align the skull to the vertical axis, torque must be increased if on the side of laterality; otherwise, C2 spinous rotations displace a farther distance to the side of C1 laterality.

C2 is the base of support for C1 and the skull. In the C1 adjustment, therefore, C2 must be moved laterally either toward the side of laterality or opposite to it, depending on the type case. The effect of the force of the C1 adjustment on the superior articulating surfaces of C2 tends to turn C2 on its posterior articulations at approximately a 40 degree angle. The torqueing mechanism controls the turning action of C2, thereby re-aligning the C2 spinous to normal position.

Reliable data concerning the effects of a mechanical force on C1 subluxations seems difficult to obtain. The *Analysis of a Chiropractor's Data* by The University of Wollongong, Australia[5], however, is a study that may be depended upon. The chiropractor who submitted the data for analysis is a competent and experienced chiropractor. Other chiropractors may want to know his experiences with mechanical adjusting.

An examination of the twenty cases listed in Table 1 of the Wollongong study (Typical Chiropractic Measurements) disclosed that the total of the misalignments of C1 laterally on the occipital condyles was 54.50 degrees. The total of reductions of C1 laterality as shown in post listings by the mechanically produced force was 9.25 degrees. 45.25 degrees of C1 laterality remained unchanged. By comparison, NUCCA records show a reduction of C1 laterality to range between 90 and 100% from a manually produced force.

In the Wollongong study of the chiropractor's pre and post listings, C1 laterality was increased by 9.5 degrees. In case number 8, no change in C1 laterality occurred. In two cases (numbers 3 and 20), C1 laterality changed from the right to the left side.

In only 3 cases did C1 laterality exceed 5 degrees, and in 13 cases less than 3 degrees. In the 3 cases of C1 laterality above 5 degrees, reduction from the mechanically produced force was only 1.50 degrees in a total of 18.50 degrees. The smaller C1 lateralities totaled 23.75 degrees in which the correction level was 6.75 degrees, indicating that the mechanical force was more effective in reducing small C1 lateralities.

In 8 cases, C1 laterality was increased by a total of 8.75 degrees.

Severe C1 rotations sometimes complicate reduction of laterality, but in these cases C1 rotation reduces in excess of C1 laterality under manual adjusting. One case listed in the Wollongong study could have had a rotation severe enough to inhibit laterality reduction. This case was an anterior 6.25. In the post listing, rotation had increased to 6.75 degrees, and laterality had increased 1.50 degrees.

Rotation of C1 in the 20 cases totaled 38 degrees in the pre listings. In the post listings, the total had increased to 39.25 degrees. In 4 cases no rotation reduction was noted; in 9 cases a reduction occurred, and in 7 cases an increase in C1 rotation occurred. The rotation reduction in the 9 cases was 8 degrees in a total of 15.25 degrees.

In the 4 cases that showed no reduction of C1 rotation, laterality of C1 increased in 2 cases and reduced in 2 cases. Of the 9 cases in which rotation of C1 showed a reduction, laterality of C1 reduced in 5, increased in 2, did not change in 1, and 1 case changed sides. The 7 cases that showed an increase in C1 rotation listed laterality as reduced in 3, increased in 3, and in 1 case changed sides. In the 4 cases in which no change in C1 rotation took place, laterality of C1 decreased in 2 cases and increased in 2 cases.

These post listings do not compare favorably with NUCCA post listings after manual adjusting.

A biomechanical relationship exists between the reduction of C1 laterality and correction of the angulation of the cervical spine (lower angle) from the vertical axis. The resistances to C1 laterality reduction in the lower angle must be overcome if a correction of C1 on the occipital condyles is to take place. The reduction will be reciprocally proportionate if all the elements of the adjustment are accurate.

When this biomechanical relationship is examined in the Wollongong study, the reductions of C1 laterality and the lower angle are not proportionate. This phenomenon raises serious questions regarding the effectiveness of a mechanically produced force in correcting the C1 subluxation complex.

The degrees of angulation of the cervical spine (lower angle) from normal position in the Wollongong study total in the pre 20 cases approximately 90 degrees. The level of reduction after mechanical adjustment totals about 36 degrees. (6 cases changed sides, moving from one frontal plane to the other.) No change occurred in 2 cases and angulation increased in 3 cases.

The largest reduction of C1 laterality (1.50°) occurred with the greatest decrease in the lower angle (7.25°). This reduction however, was disproportionate: a reduction of the lower angle of that magnitude should be more nearly equalled by a like reduction of C1 laterality. In another case (18), C1 laterality increased when a better than 50% reduction was obtained in the lower angle. Both cases show that the mechanically produced force was effective in overcoming the resistances to C1 laterality, but not in moving C1 on the occipital condyles.

Lower angle correction was greater than 50% in 6 cases and less than 50% in 3 cases. In one case only did the lower angle go to normal, and in that case C1 laterality changed from R 1 3/4 to a L 1/2. The lower angle changed sides in 6 cases, and increased in 3 cases. In 2 cases, no reduction of the lower angle took place.

In the three cases in which the lower angle reduced less than 50%, laterality of C1 reduced in all 3 cases, indicating that the mechanical force was more effective in these three cases.

In the one case in which the lower angle was corrected by the mechanical force, C1 laterality changed sides from a R 1 3/4 degrees to a L 1/2 degrees. The lower angle was a R 2 on the pre. This type subluxation, a basic type two, requires less adjustic force to reduce but the lower angle should have changed sides, not the laterality, indicating that the mechanically produced force was too great for the amount of resistance.

In the 6 cases in which the lower angle changed sides, laterality of C1 decreased in 3 cases and increased in 3 cases. The laterality reductions ranged only from 1/2 degree to 3/4 degree. In the 3 cases of laterality increase, two doubled and 1 displaced from 0 to a R 3/4. In all these cases, laterality reduction should have been complete because the mechanical force overcame the lower angle resistances.

Strangely, in the 3 cases in which the lower angle was increased by the mechanical adjustment, C1 laterality reduced in 2 cases, increasing in 1 case. In all cases laterality should have increased because the mechanical force was not capable of overcoming the lower angle resistances.

Two cases showed no lower angle reduction. Laterality in one case reduced only 1/4 degree and in the other case increased 1/2 degree.

CONCLUSION

It is difficult to analyze the cases listed in the Wollongong study in terms of biomechanical principle that are consistent in NUCCA manual adjusting. The assumptions are made that the mechanically produced adjustic forces were accurately applied, that the x-ray analyses were correct, and the force vectors were precisely computed. Errors in any of these areas could account for the loss of subluxation reductions.

It should also be made clear that manual adjusting in this paper refers solely to NUCCA manual adjusting, based on NUCCA biomechanics and the NUCCA system of adjusting. Not included are the many manipulative methods and the Palmer Recoil system.

From the Wollongong study, it must be concluded that the level of reductions are not high enough to produce adequate patient response of a lasting nature. Neither are they reductions that restore equilibrium to the C1 subluxation complex, an essential element if the vertebral corrections are to stabilize for a long enough period to allow beneficial symptomatic changes in the patient.

There is no question but what the mechanically produced force delivers a rectilinear resultant. There are, however, many other essential factors that have been discussed in this paper. A valid analysis of the Wollongong study would have to include, additionally, more information about the x-ray analyses, method of computing force vectors, headpiece placement, and the application of mechanical force.

Aside from these elements, however, the Wollongong study shows in the cases listed that the use of a mechanically produced force is not sufficiently effective in correcting the C1 subluxation complex.

REFERENCES

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[2]Molthen, D., *Digest of Chiropractic Economics*, November-December, 1980.

[3]Zimmerman, Arden D., *The Research and Development of the Specific Adjusting Machine (SAM)*, 1977.

[4]Seemann, D. C., *A Revaluation of the Lever System in Upper Cervical Adjusting, Upper Cervical Monograph*, December 1981.

[5]Aldis, G. K. & Hill, J. M., *Analysis of a Chiropractor's Data*, Department of Mathematics, The University of Wollongong, Wollongong, New South Wales, Australia.

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.

Geometric Factors in Radiology

(Continued from page 1)

Diagnostic Radiological Physics" (HHS Publication FDA 81-8150; February 1981).

The Law of Similar Triangles. Two triangles that have similar shape (corresponding angles of one triangle equal the corresponding angles of the other triangle) are said to be similar. Corresponding sides are proportional. The corresponding altitudes of similar triangles are in the same proportion as their corresponding sides. Figure 1 illustrates the relationships between similar triangles.

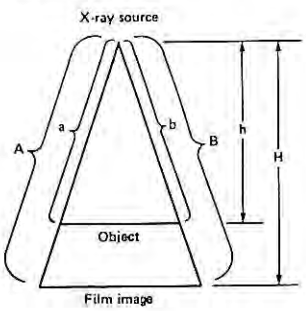

Figure 1

$$\frac{h}{H} = \frac{a}{A} = \frac{b}{B} = \frac{\text{OBJECT SIZE}}{\text{IMAGE SIZE}}$$

Inverse Square Law. The x-rays that are produced by the electrons bombarding the tungsten anode travel radially in straight lines away from the focal spot. The apparent effect is a "spreading out" or divergence of the x-rays as they get further and further from the focal spot. A visual approximation to this is the divergence of light from an overhead projector. The further the projector is moved from the screen the greater the area of the screen that is illuminated. However the same total energy or number of photons falls on the screen. Consequently, the amount of energy per unit of area per unit of time is lessened. The energy per unit of area per unit of time is the intensity. The inverse square law states that the intensity of radiation falls off as the square of the distance from a point source (focal spot).

Assume that energy in the form of x-rays is emitted from point T in figure 2. The energy per second that goes through square ABCD also goes through square EFGH. Square ABCD has an area equal to S_1^2 and square EFGH has an area equal to S_2^2. Therefore,

$$I_1 = \frac{E/SEC}{S_1^2}$$

where E/sec is the energy per second, S_1 is the length of a side of square ABCD

$$I_2 = \frac{E/SEC}{S_2^2}$$

and S_2 is the length of a side of square EFGH.

Thus $$\frac{I_1}{I_2} = \frac{S_2^2}{S_1^2}$$

By similar triangles

$$\frac{S_2}{S_1} = \frac{d_2}{d_1} \text{ or } \frac{S_2^2}{S_1^2} = \frac{d_2^2}{d_1^2}$$

where d_1 is the distance to square ABCD

and d_2 is the distance to square EFGH

Because equals are equal to equals

$$\frac{I_1}{I_2} = \frac{d_2^2}{d_1^2} \text{ (Inverse Square Law)}$$

The inverse square law explains why increasing the distance from a radiation source is effective in reducing exposure (as does decreasing the time or increasing the shielding). The inverse square law assumes that there is no absorption between the two distances; for hard x-rays air absorption is insignificant.

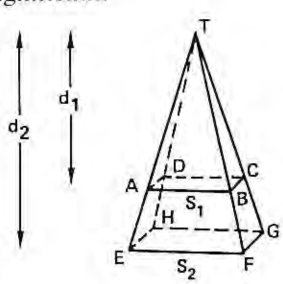

Figure 2

Magnification of the Image. Magnification is defined as the size of the image divided by the size of the object. By similar triangles magnification can be expressed as: (see figure 3).

$$M = \frac{i}{o} = \frac{SID}{SID - OID} = \frac{1}{1 - \frac{OID}{SID}}$$

where M=the magnification
i=size of the image
o=size of the object
SID=source-image receptor distance
and OID=object-image receptor distance

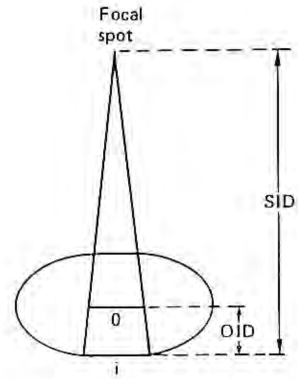

Figure 3

Magnification depends on the ratio of OID to SID. The magnification can be increased by increasing the OID or by decreasing the SID; magnification can be decreased by decreasing the OID or by increasing the SID. Because of the divergence of the x-rays the radiographic image is always larger than the object being imaged.

Because the magnification formula is based on vertical distances any object in a fixed plane parallel to the image plane will have the same magnification regardless of how the image is laterally displaced along the film plane. Since the magnification is the same the shape will be the same (figure 4).

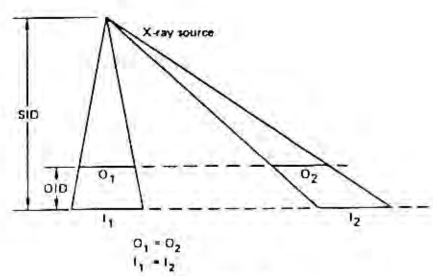

Figure 4

Distortion of the Image. All objects being radiographed are three-dimensional and thus lie in a range of distances from the film. Therefore such an object has multiple magnifications; this variation in magnification results in distortion of both the size and shape of the image.

In figure 5 the object is an ellipse (a right circular "cone" intersected by a plane that is not parallel to the base) and the image (projection of the ellipse onto the plane of the base of the cone) is a circle. This is distortion in both size and shape for a plane object.

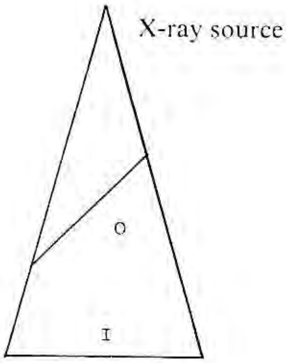

Figure 5

In figure 6 the object is a circle and the image is an ellipse. (A line from the source to the center of the circle is perpendicular to the plane of the circle.)

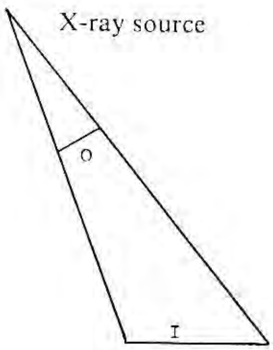

Figure 6

In figure 7 the object of a circle (a flat circular object) that is not parallel to the plane of the film. As in cases depicted in figures 5 and 6, the portion of the object closest to the film is magnified the least. Therefore the shape of the image will be distorted. The shape of the image will be egg-shaped, the exact shape and size depending upon the degree of tilting. In figure 7 the degree of tilting is constant and the distance of corresponding points of the objects are equal. Lateral displacement of the object (image) results in a change in both size and shape.

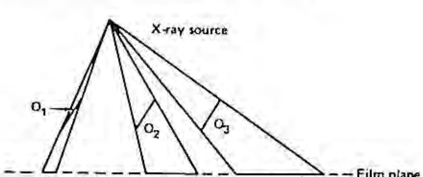

Figure 7

Three-dimensional objects compound the problems of distortion. In figure 8 a sphere is radiographed in different lateral positions. By drawing the line to the tangent lines in each sphere the degree of distortion can be assessed. The image of the sphere centered in the x-ray field will be a circle; the image of the sphere anywhere else will be egg-shaped.

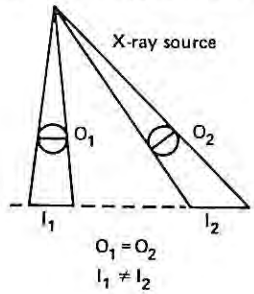

Figure 8

One other type of distortion is shown in figure 9. This distortion involves the relative positions of two objects at different distances from the film plane. The images may be either superimposed or separated, depending upon their lateral positions. This effect can be minimized by positioning the objects in the center of the field and by minimizing the overall magnification.

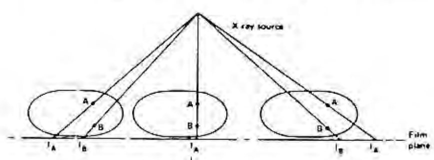

Figure 9

Geometric Unsharpness. The "unsharpness" or loss of detail is due to four major categories of causes: geometric unsharpness, absorption unsharpness, motion unsharpness, and screen unsharpness. This article shall only discuss geometric unsharpness.

Because the x-ray source is not a point source there are penumbral effects that result in loss of detail. The focal "area" does not image the edge of an object as a sharp distinction between radiographic shadow and full exposure. A partial shadow (penumbra) results instead of a total shadow (umbra). This geometric unsharpness is often the limiting factor in radiographic resolution. Figure 10 illustrates geometric unsharpness.

The penumbra is not equally shaded. The region closest to the umbra (E) receives a smaller portion of the radiation from the focal area than the region farthest from the umbra (D).

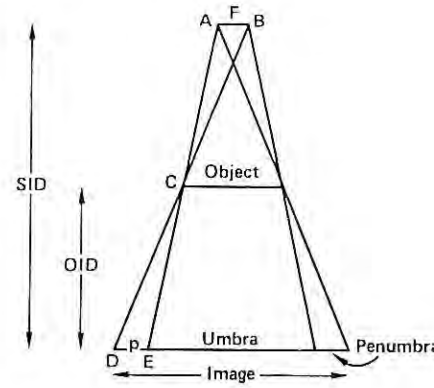

Figure 10

The penumbral width (p) can be calculated by the use of similar triangles as follows:

$$\frac{P}{F} = \frac{OID}{SID - OID}$$

$$P = \frac{(F)(OID)}{(SID - OID)}$$

Increasing the SID or decreasing the OID will decrease the size of the penumbra. Therefore those structures closest to the film will be the sharpest.

The effective focal spot size varies throughout the x-ray field. The effective focal spot is smaller on the anode side of the "central ray" and larger on the cathode side. This effect is illustrated in figure 11. This effect is more evident with greater magnification or at the edges of the film.

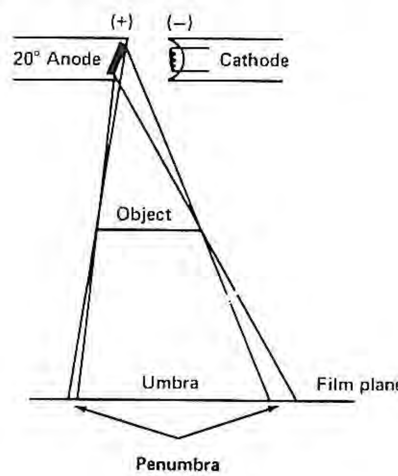

Figure 11

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HHS Publication FDA 81-8150
February, 1981

Reliability and Objectivity of Anatometer, Supine Leg Length Test, ThermoScribe II, and Derma-Therm-o-Graph Measurements

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Introduction

Clinical trials of chiropractic care should employ dependent variables which are highly reliable, objective, and valid in terms of their known statistical measurement properties. Indices having unknown measurement properties subject chiropractic to the risk of falsely concluding that care is inefficacious for several statistical reasons, including the potential masking of actual effects by inordinately large error variance. Likewise, studies of concurrent or predictive validity between variables should use measures known to be reliable and objective, or falsely low validity correlations may obscure relationships which are in fact significant.

Reliability refers to the ability of a measure to yield similar values when measured upon separate occasions by the same observer in the absence of intervening treatment. Objectivity refers to the extent to which different observers can obtain similar values for a measure from independent measurements. Validity indicates the extent to which a measurement variable does in fact measure what it purports to measure, as compared to another variable of known or accepted validity. These three measurement properties are assessed by means of correlation coefficients. Very few of the tests, measurements, and judgements in common clinical use in chiropractic analysis have been subjected to statistical tests of their measurement consistency.

Jenness[1] has demonstrated high test-retest reliability for the focusing range of the Toftness Radiation Detector, and Spector *et al.*[2] have shown high reliability coefficients for quantitative measurements which they developed for use in Moire contourography. Jenness *et al.*[3] demonstrated high reliability correlations in partial-weight measurements used to determine projected line of gravity and in postural measurements taken from photographic records of antero-posterior spinal curves as duplicated with a conformateur apparatus. Fraus *et al.*[4] found measurements of center of foot pressure to be significantly reliable. Certain components of sacroiliac joint motion palpation findings were found to be highly objective by Wiles,[5] and Upledger[6] found the cranial rhythmical impulse of the osteopathic craniosacral examination to be objective to a significant degree.

Perdew *et al.*,[7] in a rather sophisticated study of body surface temperature-measuring instruments, found an absolute thermocouple device and an absolute radiometer to yield very high reliability for measurements made at specific paraspinal points in the lower cervical, thoracic, and lumbar areas. In the same study, a differential radiometer demonstrated very high reliability of temperature measurements made at the specific paraspinal points relative to a sacral point used for calibration, and the three devices mentioned as well as a relative thermocouple instrument demonstrated high reliability in the measurement of temperature differences across the spine at specific levels. Concurrent validity between the absolute thermocouple and the absolute radiometer were lower but significant, and across-spine temperature differences showed significant concurrent validity for all combinations of the four instruments.

In a series of studies Seemann and coinvestigators[8] have found that experienced N.U.C.C.A. practitioners demonstrate a high degree of objectivity in determining height and rotation components of correction vectors for C-1 when analyzing the same sets of radiographs, and that this result persists in the analysis of separate exposures of the same patient at a single radiographic facility as well as at two different facilities both using precision N.U.C.C.A. radiograph techniques.

Early pilot studies with the Anatometer suggested that its measurements of pelvic excursion into the frontal and transverse planes are reliable and that pelvic distortion so measured is concurrently valid with the presence of a supine short leg.[9] A pilot study of reliability of Anatometer measurements was undertaken by Biollo and Anderson,[10] and Anderson[11] made supine leg length and frontal and transverse plane Anatometer measurements on a group of weightlifters before and after a powerlifting competition, but reliability and objectivity correlation coefficients have not as yet been published for either the supine leg deficiency or the measurements obtained from the Anatometer.

It was therefore the object of the present investigation to establish minimum known measurement properties for a number of noninvasive clinical measures and judgements commonly used in chiropractic analysis, including Anatometer measurements, supine leg length test, suboccipital heat break as measured with a differential thermocouple device, and temperature difference over the C-1 transverse processes as measured with an infrared radiometer.

Methods

Twenty-six volunteer students and spouses recruited from the Fall 1982 entering class at Texas Chiropractic College, who met certain requirements and abstained from receiving intrusive procedures for a one-month period, were repeatedly examined by qualified clinical observers on two consecutive days using a number of standard clinical indices. Eleven clinical observation stations were established in the T.C.C. Campus Clinic, and subjects were rotated sequentially through these stations, with specific observations being made by a clinician at each of the stations.

Subjects

The purpose and nature of the project was explained at an orientation session on September 2, 1982, to approximately 160 new students entering Texas Chiropractic College. Of the total number, 56 volunteered to participate in the study, certifying that they were not at that time seriously or acutely ill or pregnant. Subjects agreed to abstain from receiving any adjustment, manipulation, massage, or physical therapy until they were dismissed from the study one month later and were cautioned that they might develop pain or illness as a result of not receiving chiropractic care. Subjects agreed to notify the principal investigator and drop out of the prospective study group if they developed any health problems or became pregnant during the interim. They were also informed that their participation was strictly voluntary and they could withdraw from the study at any time. No monetary or other incentive was offered.

Of the original 56 volunteers, 34 withdrew from the study prior to data collection, leaving a prospective study group of 22. Four students' spouses, two males and two females, each of whom certified that they qualified under the aforementioned conditions, were added to the study group at the beginning of data collection, making a total of 26 subjects.

Subjects were asked not to use any coffee, tea, or other stimulant, nor any sugar, nor any drugs of any kind from the time of awakening on each of the data collection days until they were dismissed for the day. They were asked not to smoke for at least 1½ hours prior to their arrival for data collection, nor during breaks in the rotation system, and were asked not to eat for 2 hours prior to their appointed arrival time. Subjects were asked to wear loose clothing on the lower body and to avoid wearing heavy, restrictive pants or belts. No specific instructions were given regarding footwear.

Subjects' ages ranged from 19 to 45 years, with a mean age of 29.2 years, a median of 25.8, and a mode of 26. There were 18 males and 8 females. The range of number of days since the last adjustment (for subjects who had previously received chiropractic care) was from 31 to 3,009 days; the mean was 335.7, and the median was 563.5. Eight subjects had never received adjustment or manipulation and constituted the mode of the distribution.

Materials

Equipment used to generate the data currently being reported included: an Anatometer, a patented postural measurement device typically used in a clinical setting to determine the presence and degree of biomechanical distortion in the body; an Utterbach chiropractic adjusting table for the supine leg length test; a ThermoScribe II differential thermocouple instrument, which graphs continuously heat differences across the spine as registered from two contacts (with senior-size pickup); and a Derma-Therm-o-Graph, Mark V, Model C, infrared radiometer, which graphs continuously or discretely the temperature of the skin at the point in front of its port. Additional equipment used in other phases of data collection included a Chirotron device for measuring standing weight distribution on each foot, a tape measure, a goniometer, and various chiropractic adjusting tables permitting prone positioning of the patient.

Procedures

On October 2 and 3, 1982, subjects arrived in groups of approximately 5 at intervals of 30 minutes, beginning at 1:00 p.m. After checking in and recertifying their eligibility at the Clinic reception desk they proceeded to a waiting area, from which they were called individually at intervals of approximately 5 minutes to begin rotation through the clinical stations. Upon completion of the first rotation, subjects were offered fruit, juices, and nuts during a rest period of about 15 minutes, after which they returned to the waiting area and were individually called for a second rotation. On completion of the second rotation, they were dismissed for the day. The procedure was identical on the two days (except as noted below).

Clinical stations were arranged in the following order:

1. Derma-Therm-o-Graph (DTG) and Chirotron.
2. Podiatric examination of the lower extremity, including limb measurements and range of motion of joints from hip to forefoot.
3. ThermoScribe II recording, with the cervical spine recorded first from about C-7 to the occiput and the lower spine recorded next, from about S-2 to T-1.
4. Standing portions of the Logan Basic physical analysis,[12,13] which involved palpation of the sacroiliac joints and ligaments, S-2, PSIS, iliac crests, and greater trochanters.
5. Assessment of the supine short leg and Anatometer measurements.
6. Selected Sacro Occipital Technique indicators,[14] including short leg, heel tension, leg lift and cervical compaction, and arm fossa test.
7. Prone portions of the Logan Basic physical analysis, which involved palpation of Achilles' tendon, medial knee tenderness, gluteal and erector spinae muscles, sacral apex, ischium, and sacrotuberous ligament.
8. Static palpation of the cervical spine in the supine position, from occiput to C-7.
9. Static palpation of the lower spine in the prone position, from T-1 to coccyx.
10. Motion palpation of the full spine and pelvis, from occiput to coccyx and including the sacroiliac articulations, by the method of Gillet.[15]
11. Motion palpation, repeated by a second observer.

On the second day of observation the observers rotated from their previous stations, remaining within their respective fields of technical specialization, so that subjects were examined at each station by Dr. A for both rotations of the first day and by Dr. B for both rotations of the second day. The Sacro Occipital checks were omitted on the second day, and the rest period between rotations was lengthened accordingly. At each of the stations the clinical observer was assisted by a data recorder who completed the appropriate portion of the subject's data form according to the observer's verbal instructions. Data recorders were volunteer junior and senior clinic interns at T.C.C.

Measurement Variables

Of the measures observed, the present analysis considers:

1. Supine leg deficiency, recorded to the nearest one-eighth inch, with a right short leg recorded as positive and a left short leg recorded as negative.
2. Anatometer frontal plane measurement, recorded on the patient's right side, with superiorward displacement recorded as positive and inferiorward displacement as negative.
3. Anatometer transverse plane measurement on patient's right, with anterior displacement recorded as positive and posterior displacement as negative.
4. Anatometer fixed point measurement, with displacement to the right recorded as positive and displacement to the left recorded as negative.
5. ThermoScribe II suboccipital heat break, with break to the right recorded as positive and break to the left recorded as negative, in graph point units, with half-point estimates allowed.
6. Heat difference between the skin over the right and left styloid fossae, estimated to the nearest .05 degree from DTG graphs of the two areas, recorded as positive when the right side was warmer and as negative when the left side was warmer.

Anatometer measurements of frontal and transverse plane displacement are ordinarily recorded on the side of the supine short leg in clinical practice. In this study these measures were always recorded on the right in order that possible errors in determining the side of leg deficiency would not create artificial error in the Anatometer readings. Anatometer measurements were generally taken with the patient wearing shoes. After these measurements were taken, the foot pedals were raised or lowered on the short leg side to a degree sufficient to balance the transverse plane to zero; however, these data are not analyzed here.

ThermoScribe II suboccipital heat breaks were estimated by the clinical observer at the time of their recording. DGT heat differences were estimated from graphs by a research assistant after the data collection.

Data Analysis

Each of the measures is defensible as being of interval scale or better with the possible exception of the supine leg length test. It could be argued that, since the leg deficiency is a perceptual judgement on the part of the observer rather than a reading on a demarcated scale, the measure is of only ordinal scale. Therefore ordinal measures of central tendency and dispersion are reported for the supine leg length test.

With N = 26 the central limit theorem cannot be invoked and parametric correlational procedures are inappropriate. Furthermore, the distributions of most of the measures were, by inspection, grossly non-Gaussian (as was expected), and neither normal distribution nor homoscedasticity could defensibly be assumed. Therefore Spearman's rank correlation coefficient, r_S, was used as the correlational statistic.[16,17,18] As numerous tied scores were present, the formula incorporating a correction for ties was used.[16] Since the direction of correlation was predicted as positive, a one-tailed test of significance was used, with maximum significant alpha defined as .05.

Results

Table A presents for each measure the reliability coefficients for observations on day 1 and day 2, the objectivity coefficient between the first observation on each day (taken as the least-perturbed value), and measures of central tendency and dispersion for the first observation of the first day.

The supine leg length test was strongly bimodal at –2 (1/4-inch left short leg) and +3 (3/8-inch right short leg), demonstrating that the vast majority of subjects were subluxated at C-1. Only one subject showed no leg deficiency on the first observation.

Table A: Reliability and Objectivity of Analytic Measures

Measure	Reliability Day 1	Reliability Day 2	Objectivity	Mean(a)	Standard Deviation(b)
Supine Leg Length Test	.66**	.81**	.52**	-0.5	8
Anatometer Frontal Plane	.08	.21	-.08	-1.0	0.97
Anatometer Tranverse Plane	.54**	.23	.15	-0.37	1.80
Anatometer Fixed Point	.49**	.62**	.36*	-0.02	0.89
ThermoScribe Suboccipital Break	-.33	.06	.03	0.02	2.97
DTG Difference at C-1	.60**	.46*	-.03	0.18	0.58

** p less than .01
* p less than .05
(a) Except median for supine leg length test.
(b) Except range for supine leg length test.

Both reliability coefficients were significant at better than the p = .01 level, as was the objectivity coefficient, although the objectivity was considerably lower than either reliability figure.

Anatometer frontal plane displacement was likewise bimodal at –2 degrees and 0 degrees. Neither of the reliability coefficients nor the objectivity coefficient was statistically significant. Transverse plane measurement was trimodal at 0, +0.5, and +1 degrees. Reliability for first-day measurements attained statistical significance at better than p = .01, but second-day reliability and the objectivity coefficient failed to reach significance. The fixed point measurement was unimodal at zero with a strong second peak at +1 degree. Both reliability coefficients were significant beyond p = .01, and the objectivity coefficient, while low, was significant beyond p = .05.

The ThermoScribe II suboccipital heat break was strongly unimodal at zero (11 scores), with the remainder of subjects demonstrating breaks of from 2 to 6 points to the left or right. Reliability on day 1 was –.33, which was non-significant with either one-tailed or two-tailed tests. Day 2 reliability and objectivity for this measure were also non-significant.

The DTG heat difference at C-1 was reliable past p = .01 for day 1 and reliable past p = .05 for day 2. Objectivity was non-significant. The distribution of this measure was bimodal at −0.2 and +1.0 degrees, with the majority of subjects demonstrating the right side warmer.

Discussion

While the sequence of the examination stations was arranged in what the investigator and clinical participants believed to be a least-intrusive to most-intrusive order, it appeared that the number and type of variables measured made the entire procedure quite intrusive, at least in terms of perturbing several of the measurement variables analyzed here. Indeed, several of the subjects complained of considerable soreness at the end of the first day of observation, and almost all offered such complaint at the conclusion of data collection, gratefully accepting manipulation from some of the clinicians.

The motion palpation procedures, in particular, may have caused distortions in the measurements, as several subjects reported audible releases during this evaluation. It must also be remembered that Toftness[17] has demonstrated profound spinal change with procedures involving only several ounces of skin-contact pressure. Therefore the static palpation procedures may also have influenced subsequent measurements.

It is noteworthy that, of the Anatometer measurements, those which directly measure pelvic distortion demonstrated the lowest consistency. It may be that the repeated Logan evaluations, which involved palpating the site of prospective adjustive contact, were more intrusive that had been anticipated. Also, obviously, the supine leg check would be likely to demonstrate higher correlations had subjects been instructed on proper footwear. The lack of significance in the DTG objectivity correlation appears paradoxical and may be due to slight differences of placement by the two observers.

For these reasons it is impossible to conclude that those measures demonstrating low reliability or objectivity, or both, in this study are in fact incapable of producing consistent patient evaluation. The low correlations observed may have been due primarily to the intrusiveness of the procedure and, indeed, these measures may represent the most delicate measures of spinal imbalance studied. Therefore the study should be repeated using a much more limited set of evaluative measures, and those correlations which did reach significance may be considered to represent the minimum reliability and objectivity of the measures involved.

Acknowledgements

The participation of John B. Clark, D.C., W. Andrew Shepherd, D.C., David P. Mohle, D.C., and Don Fink, D.C., as clinical observers in this study is most gratefully acknowledged, as is the assistance of Loyola M. Reel in the data analysis. Drs. James H.G. Reeves, Roland Ferguson, Randolph Andrews, and Jillana Burgess, and Michael Polson served as data recorders. The gratis loan of equipment by Benesh Tool and Manufacturing Co. of Monroe, Michigan (Anatometer); Murdoch Engineering, Inc., of San Leandro, California (ThermoScribe II); and Derma Therm, Inc. and Chirp, Inc., of Dravosburg, Pennsylvania (DTG) made this phase of the project possible and is greatly appreciated.

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THE SEVENTEENTH ANNUAL NUCCA CONVENTION

From Saturday, May 7th through Tuesday, May 10, 1983, the National Upper Cervical Chiropractic Association, Inc. (NUCCA) held its annual Convention and Educational Seminar. The program was held at the Howard Johnson Motel, Monroe, Michigan. Doctors and college students from several states and Canada attended. Also attending was Dr. Norboru Ikuse from Japan. The conference hall was filled to capacity.

Shown above with Dr. Ralph R. Gregory, NUCCA President, is Dr. Norboru Ikuse of Japan. Dr. Ikuse traveled to Michigan especially to attend the 1983 NUCCA Convention and Educational Conference. Receiving his chiropractic education in the United States, Dr. Ikuse has attended previous NUCCA conventions.

The educational seminar was cosponsored by the University of Toledo, and approved for license-renewal by several states, including British Columbia, Canada. The University of Toledo will present a Certificate of Completion with the appropriate number of C.E.U.s to each participant.

The invocation was given by the Reverend F. Joseph Atkinson, Pastor of the Redeemer Baptist Church of Monroe, Michigan.

Dr. M. Wayne Clark, Oklahoma City, Oklahoma served as Convention Chairman, and Daniel C. Seemann, Ph.D., University of Toledo, supervised the educational program.

James F. Palmer, M.S., of the University of Toledo, lectured on X-ray and X-ray Physics. Elmer A. Addington, M.A., D.C., presented the research conducted on upper cervical and the anatometer at the Texas Chiropractic College. Daniel C. Seemann, Ph.D., NUCCRA Research Advisor, lectured on C1 Subluxation Classifications, Mechanical Levers in the C1 Adjustment, and Vertebral Resistances to the C1 Adjustment.

Basic Film Analysis was taught to beginners by Drs. Teresa and Keith Denton. Advanced Film Analysis and Adjusting Biomechanics by Dr. Ralph R. Gregory, assisted in the practical work by Drs. Teresa and Keith Denton. Doctors and college students were instructed in x-ray alignment procedures and x-ray patient placement by Dr. Marshall Dickholtz, Sr. Leg checking exercises, headpiece placement, and anatometer examination were conducted by Drs. Lloyd and Lonnie Pond, M. Wayne Clark, John B. Clark, and A. Berti at different stations. Dr. Larry Schrock of Indiana assisted.

Dr. M. Wayne Clark, Oklahoma City, Oklahoma

Stations were set up and the class was rotated in groups from one station to another, thereby giving each participant an opportunity to analyse actual films, place patients on the adjusting

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

tables (dummies were used for this exercise) for each of the basic types, work on biomechanical problems at the tables, engage in leg-checking exercises, and be instructed in practical adjusting techniques. Participants were also given subluxation listings and instructed on various adjustic standing positions, using the dummies as patients. Actual office conditions were thereby simulated, and participants were taught a practical take-home-and-use approach.

Each registrant in the educational seminar automatically becomes a NUCCA member for the ensuing year, entitling her/him to all the membership privileges: receiving the Monograph, the official NUCCA magazine, all releases on research findings, and notification of all activities of NUCCA-NUCCRA.

NUCCA hosted a banquet Monday evening, May 9th, at the French-Italian Inn. Dr. Albert Berti was master of ceremonies. Dr. John B. Clark of Texas was roasted.

Highlights of the 1983 NUCCA Convention

RUTH O. GREGORY MEMORIAL FUND

At its 1982 November Board Meeting, the Directive Board of the National Upper Cervical Chiropractic Research Association, Inc. (N.U.C.C.R.A.) unanimously voted to establish a Ruth O. Gregory Memorial Fund. The Fund was established in appreciation for the years of effort and of unselfish devotion that Ruth O. Gregory freely gave to the NUCCA-NUCCRA organizations. Her contributions frequently involved sacrificing her personal desires.

Many contributions were received from doctors, patients, and friends in Ruth Gregory's memory immediately following her untimely death on June 9, 1982. These contributions were used to finance NUCCRA Research projects, thus helping the profession which she loved and served so long and faithfully. Previous donations have been listed in the October, 1982 and the January, 1983 Monographs.

The Ruth O. Gregory Fund is to exist for the life of the NUCCA-NUCCRA organizations and cannot be financially depleted. It is felt that in this way Ruth O. Gregory continues to aid in the advancement of the Chiropractic profession through bona-fide research, a concept in which she believed so strongly.

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

Fairborn Chiropractic Assoc., Inc.	Ohio
Dr. K. Fox	Ohio
Dr. D. R. Juszczyk	Ohio
Mr. John Savage	Ohio
Dr. D. Monger	Oregon
Dr. E. A. Addington	Texas
Mr. Paul Miller	Iowa
Dr. Janice Lindgren	Oklahoma
Mr. J. P. McNerney	Ohio
Dr. T. A. Denton	Michigan
Dr. John Houtman	California
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Mr. D. A. Miller	Michigan
Dr. & Mrs. Keith Denton	Michigan
Dr. Ralph Gregory	Michigan
Dr. Christopher Kemper	California

Donations to the Ruth O. Gregory Memorial Fund should be made out to NUCCRA and are tax deductible. Many thanks to all the donors who were so kind and generous.

Announcement

Dr. Nathan J. Saltzman announces the opening of his office at 9204 Menaul, N. E., Albuquerque, New Mexico. A native of Nebraska, he moved to New Mexico in 1973 and received his undergraduate education at New Mexico State Branch College in Farmington, New Mexico.

In 1979 Dr. Saltzman enrolled in Palmer College of Chiropractic where he was active in the NUCCA club and attended educational conferences and seminars of the National Upper Cervical Chiropractic Association, Inc. Upon graduation in March 1982, Dr. Saltzman interned with Drs. Lloyd and Lonnie Pond in Farmington, New Mexico for five months and moved to Albuquerque in the Fall of 1982 where he has opened his practice.

Dr. Saltzman is licensed in the State of New Mexico and is a diplomate of the National Board of Chiropractic Examiners. He and his wife Marilyn plan to make Alburquerque their permanent home.

IN MEMORIAM

The Monograph was saddened to learn of the death of Dr. Richard Helzer, 62, of Fresno, California. Dr. Helzer died of a heart attack on April 15, 1983. He was a graduate of the Palmer College of Chiropractic, Davenport, Iowa, a member and supporter of NUCCA, and a veteran of World War II. He was affiliated with the Masonic Temple of Scottish Rite.

Dr. Helzer conducted an upper cervical practice in Fresno, California for 18 years, and attended the NUCCA Conventions and Educational Seminars regularly.

Dr. Helzer is survived by his wife, Bernice, a son, Rick, two sisters and two brothers. The Monograph extends its deepest sympathy to Dr. Helzer's survivors.

NUCCA SEMINAR DATES

Reservations have been confirmed with the Howard Johnson Motor Lodge, 1440 North Dixie Highway, Monroe, Michigan 48161, for the November NUCCA Educational Seminar, and the 1984 NUCCA Convention and Educational Program. The Fall seminar will start on Saturday, November 5, 1983 and conclude on Wednesday, November 9th at 12:00 noon.

The 1984 NUCCA Convention and Educational Program will be held from Saturday, May 5, 1984 through Tuesday, May 8, 1984. The 1984 NUCCA Convention will be the eighteenth NUCCA Convention. It will conclude at noon on Tuesday, May 8th.

Both these seminars are very practical, including subjects of take-back-to-the-office-and-use nature. Office conditions are simulated insofar as film analysis and adjusting are concerned. Several qualified instructors are provided so that personal attention can be given registrants. Recent NUCCRA research findings are taught; both basic and advanced work is included.

Chiropractors and college students who wish to attend either the Fall seminar or the 1984 NUCCA Convention should register with NUCCA early because attendance must be limited. In the past, applicants unfortunately were refused because of lack of space.

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

The Upper Cervical
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THE NATIONAL UPPER CERVICAL CHIROPRACTIC ASSOCIATION, INC.
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Dr. Ralph R. Gregory
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UPPER CERVICAL DIRECTORY

The need for a directory of upper cervical oriented chiropractors has long been felt in the chiropractic profession. Chiropractors and laymen are frequently telephoning and writing NUCCA Headquarters requesting the names of doctors. Now the INTERNATIONAL UPPER CERVICAL CHIROPRACTORS DIRECTORY (I.U.C.C.D.) is being published by Dr. W. G. Laney of Yakima, Washington. This Directory will fill the long-felt need.

NUCCA doctors who want to be included in the I.U.C.C.D. should contact Dr. W. G. Laney, Glenmoor Green Professional Centre, 4702 Tieton Drive, Yakima, Washington 98908.

MONOGRAPH

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ELECTION OF NUCCA DIRECTORS

The following doctors were elected directors of the National Upper Cervical Chiropractica Association, Inc. (NUCCA) at the Annual Business meeting on May 9, 1983:

Dr. Marshall Dickholtz, Sr. of Ill.
Dr. Lloyd Pond of New Mexico
Dr. Albert Berti of Canada
Dr. R. R. Gregory of 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.