THE UPPER CERVICAL
MONOGRAPH

Vol. 7, No. 2 *Published by* **THE NATIONAL UPPER CERVICAL CHIROPRACTIC RESEARCH ASSOCIATION** September 2009

TABLE OF CONTENTS

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Comments from the Editor on Contents of this Issue:

The September 2009 issue (Vol. 7, No.2) of The Upper Cervical Monograph includes early results of the finite element modeling research team at the University of Toledo and provides the poster board content that was used at two different conferences. Two articles, both of which involve the same population of non-migraine headache patients, follow. The first of the two articles is from the Journal of Vertebral Subluxation Research (JVSR; June 4, 2009) and is reprinted. [taken with permission of author, according to JVSR policy] The second is an addendum to the non-migraine headache study to address if occupational effects exist. This is followed by a reprint of the brief history of the "hypertension study" [taken with permission] from the September 2008 issue of Canadian Chiropractor (Vol. 13, No. 6; pp42-44).

Associate editor Dr. Michael Thomas provides an excellent first look in the Monograph of Dr. H. Biedermann, a German MD, whose specialty is structured "manipulation" of children under 2 years of age. This is followed by an introductory article on a short literature history of chronic low back pain (CLBP) as experienced by upper cervical chiropractors and compares it to the site- of- pain manipulation paradigm as expressed and summarized in the JMPT white papers.

Upper Cervical Research Foundation Mission Statement

The Upper Cervical Research Foundation is devoted to developing and facilitating comprehensive research to investigate the relationship between the biomechanical and neurological balance of the upper cervical spine and its profound effect on human health and well being.

Editorial
Confronting Our Absolute Stupidity. Several Suggested Readings

Martin Schwartz in the Journal of Cell Science [121, 1771] (2008) put forth the essay titled: The importance of stupidity in scientific research. In the essay the author recounts that as a third year graduate student asking input about his graduate research problem from a Nobel Laureate ; the Nobel Laureate didn't know the answer yet he knew at least a 1000 times more than the graduate student. "That's when it hit me (the graduate student): nobody did. That's why it was a research problem. The crucial lesson was that the scope of things I didn't know wasn't merely vast; it was for all practical purposes infinite. That realization, instead of being discouraging, was liberating. If our ignorance is infinite, the only course of action is to muddle through as best we can. Science involves confronting our 'absolute stupidity'." Ignorance is thus not a problem but "productive stupidity", meaning according to Schwartz "being ignorant by choice", is a very critical problem. Is being biased, i.e., unable or unwilling [choice] to form a fair or objective opinion, somewhat the equivalent of being ignorant by choice? How can NUCCA and NUCCA research more effectively deal with bias or ignorance by choice of others in the chiropractic profession?

The answer may be in part a more structured approach in research where what is not said is understood to be as important as what is said or even how and under what circumstances something is said. One problem appears to be that we give too much information too soon and often without building the appropriate literature foundation. A submittal for publication is not necessarily the end of a study if the material cannot get published. The suggested strategy for getting published is to go to scientific/medical journals first (if appropriate) while leaving the chiropractic interpretation of that same material for the chiropractic journals. Keep in mind that time tables do not run science. It happens when it happens and it does so with a lot of work and mistakes involved, even with the most experienced and brightest researchers.

Some suggested readings include "Evaluating the Scientific Potential of Chiropractic: A Complete Paradigm Shift by Burl Pettibon, DC and published in Dynamic Chiropractic [August 26, 2008, Vol. 26, Issue 18] A key portion of the well-focused article by Dr. Pettibon is the following observation:

"***Presently, the college X-ray departments teach that subluxations cannot be seen on X-ray. Therefore, one could conclude that if something cannot be seen, it also cannot be accurately measured. To accurately measure the direction and amount of spinal displacement (vector quantities), the measurement has to originate from an established origin. Since no origins are established from which to measure, the colleges are forced to teach spinal displacements as a direction of displacement only, such as PRI and/or PRS, which are nonscientific scalar quantities.***

Without scientific measuring procedures, the schools revert to embracing and teaching the medical profession's X-ray goal of identifying pathologies and fractures while downplaying and/or disregarding spinal displacements. Without a scientific method for identifying, taking and measuring spinal displacements and the correction or worsening of these displacements produced by adjusting and/or other clinical procedures, the chiropractic colleges have added more diagnostic- and symptom-orientated clinical procedure classes to their curriculum. This is despite the fact that symptomatic disease diagnosis and treatment has proven to be less than 20 percent accurate."

This again brings focus back to measuring which is all important. Dr. Pettibon argues for a new paradigm for advancing chiropractic which must include "systems of care that ensure spine and posture rehabilitation and correction".

Another article well worth reading is "Neck pain and disability outcomes following chiropractic upper cervical care: a retrospective case series" by Roderic P. Rochester, DC, and published in JCCA 2009; 53(3), 173-175. A key result of this practice based research (PBR) is the following:

"Cases with the post-adjustment skull/atlas alignment measurement (atlas laterality) that were changed more than 30% on the first visit toward the orthogonal alignment predicted a statistically and clinically significant better outcome for Neck Disability Index in 2 weeks."

Dr. Rochester's research supports R. R .Gregory's original research that better corrections provide better outcomes… something that all NUCCA practitioners know through experience, especially by those who progress through NUCCA certification.

Development of a Head-Neck Finite Element Model for the Investigation of Subluxation-Based Upper Cervical Chiropractic Manipulation

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INTRODUCTION

Chiropractors routinely manipulate cervical spines for treating neck pain and headaches. However, limited quantitative information is available about the mechanical response (e.g., displacement, ligament stress, load transfer) during a cervical spinal manipulation. Cadaver based studies can document the changes in motion due to the forces exerted during spinal manipulation. However, it is not practical to simulate the pathology that the Chiropractors are trying to resolve. Furthermore, *in vitro* studies are unable to document the forces, stresses and strains in various spinal structures in response to the applied forces. Finite element technique is most suitable for such investigations, and thus compliments the cadaver investigations. Many finite element (FE) models have been developed to understand the biomechanics of the human cervical spine for the intact, injured, or stabilized states. However, similar FE models for the understanding the effects of the cervical chiropractic manipulation are sparse. Our goal is to develop an FE cervical spine model for this purpose. The efficacy of such a model is illustrated for the subluxation-based NUCCA cervical chiropractic manipulation technique.

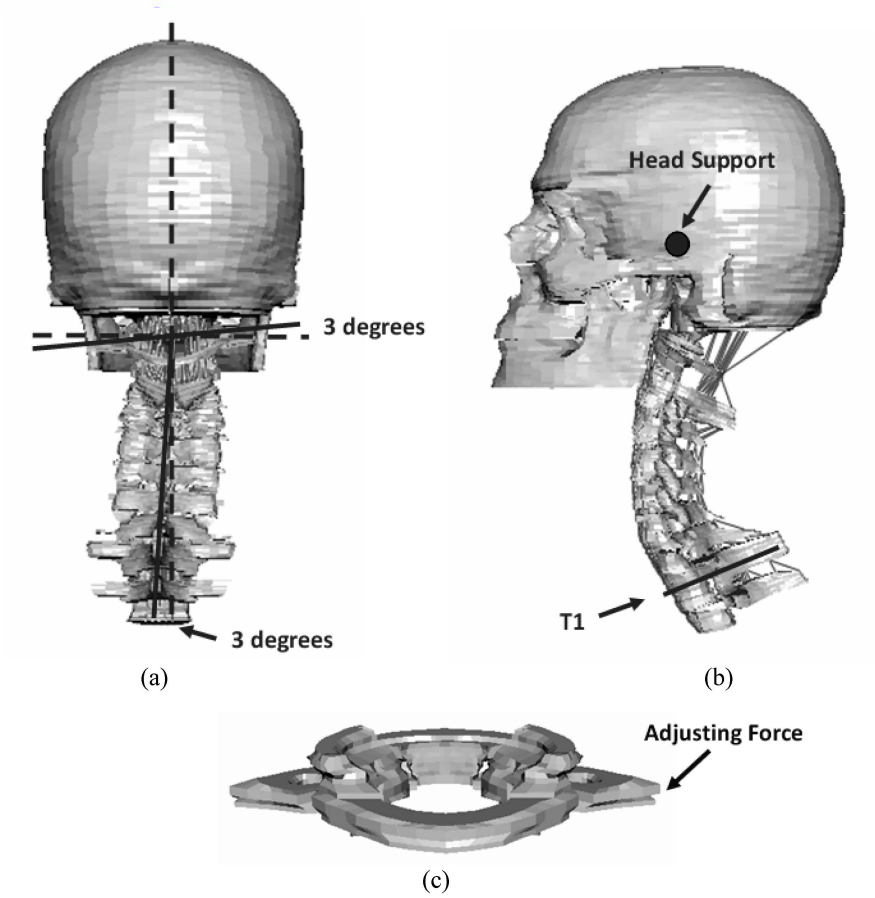

Figure 1. (a) The misaligned FE model with the head free of tilting, 3° of the C1 laterality, and 3° of cervical spine angular rotation into the right frontal plane; (b) Boundary conditions defined during the correction process, including a few nodes on the side of the skull fixed so to simulate the head support, and the mid-plane of T1 vertebral body being fixed; (c) Loading condition during the correction process - the simulated adjusting force applied at the tip of the C1 transverse process and along the determined vector direction.

METHODS

A 3D non-linear FE model of an intact Skull–T2 spine was created based on 1mm transverse CT scans of a female with no spinal disorders using the software ImageJ and ABAQUS. The material properties were from the published data including previously developed and validated FE models [1,2].

A misaligned FE model (**Fig. 1a**) is then created based on the intact Skull-T2 model by imposing boundary conditions so that the spinal column has a 3° deviation from the vertical axis in the right frontal plane (Angular Rotation), the Atlas forms a 3° side slip relative to the transverse plane (C1 Laterality), and the skull is carried into the right frontal plane but remains vertical.

With the misaligned FE model, two steps were defined to simulate the adjustment. First, the skull was moved so that the center of mass of the skull and the center of T1 are on a line parallel to the horizontal, thus simulating correct chiropractic patient placement on the headpiece and on the adjusting table. Secondly, a force was applied at the tip of the Atlas transverse process along a pre-determined correction angle (**Fig. 1c**). For the boundary conditions, a few nodes on the skull in the supported area were fixed to simulate the head support, and the mid-plane of T1 vertebral body was fixed (**Fig. 1b**).

RESULTS

The FE model was subjected to an adjusting force applied in the frontal plane at six different angles from 13°–28° above the transverse plane. **Table 1** shows adjusting force directions and magnitude and resulting C1 Laterality for cases with corrected Angular Rotations. Four cases (16°, 19°, 22°, 25°) predicted C1 Laterality to be within the 0.75° window, among which, 22° adjusting angle gave the least remaining misalignment of -0.05°. At 22° adjusting angle, changes of misalignment parameters during patient orientation and adjustment are shown in **Table 2** and **Fig. 2**, and the relationship with the corresponding adjusting force are shown in **Fig. 3**.

Angle of Adjusting Force	Magnitude of Adjusting Force	C1 Laterality
13°	12.18 N	0.82°
16°	11.37 N	0.34°
19°	10.27 N	0.15°
22°	9.91 N	-0.05°
25°	9.86 N	-0.44°
28°	10.67 N	-0.94°

Table 1: The predicted magnitude of adjusting force and post-adjustment C1 laterality for six adjusting angles from 13°–28°

	Pre-adjustment	Post-orientation	Post-adjustment
C1 Laterality	3.00°	6.50°	-0.05°
Angular Rotation	3.00°	1.84°	0°

Table 2: The Pre- and Post-adjustment misalignment parameters in the FE model at 22° adjusting angle

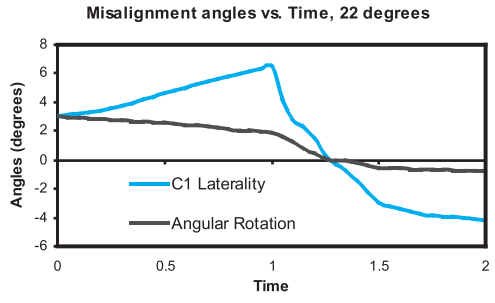

Figure 2. The predicted misalignment angles vs. Time at 22° adjusting angle

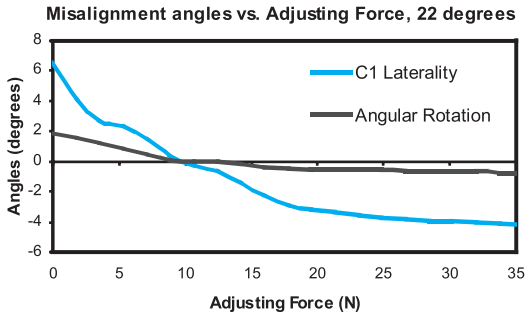

Figure 3. The predicted relationship between misalignment parameters and adjusting force

CONCLUSIONS

The current ligamentous head-neck FE model correlates well with the experimental data and is qualitatively sufficient to show the realigning process of the NUCCA chiropractic procedure for a specific misaligned case. The results indicated that in order to reduce both the C1 Laterality and the Angular Rotation simultaneously and proportionally, the adjusting force has to be applied in the proper orientation and magnitude.

REFERENCES

1. Puttlitz et al., Spine 2001; 26(22):2449-55
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ACKNOWLEDGEMENTS

Work was supported in part by Upper Cervical Research Foundation (UCRF/NUCCA), The Tao Foundation (Calgary, Canada), Greg Buchanan, and Standard Process.

Editor's Comments: Material was presented as "poster boards" at both the NUCCA seminar in St. Louis in April and also at the June 2009 ASME Summer Bioengineering Conference in Squaw Creek, California. The above abstact will be part of the published summer proceedings. The same material was presented by J. Palmer as part of the research panel discussion in St. Louis. It should be noted that asymmetry was specifically introduced into this model for this paper. [This aymmetry was on one side of the superior surface of C2, which had the result of making the space between C1 and C2 asymmetric].

Improvement in Radiographic Measurements, Posture, Pain & Quality of Life in Non-migraine Headache Patients Undergoing Upper Cervical Chiropractic Care: A Retrospective Practice Based Study

James Palmer*; Marshall Dickholtz Sr.

Abstract

Background: There is research supporting nociceptive structures in the cervical spine as a common origin for symptoms meeting International Headache Society diagnostic criteria for tension-type headache (2) and cervicogenic headache (11.2.1). The potential to screen non-migraine headache subjects for referral based on posture, and to have that referral meet with a high level of success, is important to health care and to headache research.

Objectives: To establish if signs of postural imbalance and X-rays provide measurable indicators of cervical disarrangement related to non-migraine headaches; to determine the effectiveness in everyday practice of manual vectored adjustment of the atlas for attenuation of non-migraine headache pain intensity; and to illustrate some of the advantages and disadvantages of practice based research.

Methods: Progression of patients with non-migraine headache following manual, vectored-adjustment of the atlas was assessed by and correlated with pre- to post- adjustment changes in measurements from cervical radiographs, wellness and pain scale instruments, and load and non-load bearing modes of posture. Pain assessments using the visual analog pain scale were conducted at each office visit for patients who were adjusted once, were normalized to the data of the first visit, and expressed as a decay curve.

Results: There was statistically significant improvement in postural measurement, X-ray measurements, and in all wellness categories from pre-treatment to post-treatment. Time series analysis of the visual analog pain scale assessments showed a significant reduction in pain intensity within two weeks of treatment for those who received only a single treatment and that the pain intensity for the single-treatment group decreased by approximately 75 percent over the study period.

Conclusion: Correction of the atlas subluxation complex using National Upper Cervical Chiropractic Association protocol may be a possible analgesic for non-migraine- especially cervicogenic- headache. Correlations between pre- and post-treatment changes in posture, X-ray, pain intensity, and wellness measurements support the clinical significance of using a vectored force for manual correction. Leg length alignment asymmetry taken in a supine position may be the easiest postural measurement to address neurological insult to the C-1 joint and could be valuable in making a more robust differential diagnosis in future headache studies. A degree of uncertainty exists in retrospective studies even when part of a practice based-research program.

Key words: non-migraine headache, cervicogenic headache, tension headache, SF-36 questionnaire, VAS pain assessment, supine leg length alignment asymmetry, contractured leg, atlas laterality, atlas , C-1, vectored manipulation, practice based research.

Abbreviations: VAS visual analog scale, SF-36 Medical Outcomes Study 36-Item Short Form survey, LLI leg length inequality, PF physical functioning, BP bodily pain, NS not significant, AFP Anatometer frontal plane, ATL atlas laterality, PBR practice based research.

The authors acknowledge support from the Upper Cervical Research Foundation (Monroe, Michigan; www.ucrf.org) and statistical analysis by J.Cord Palmer (Johns Hopkins University)

Introduction

In 1994, the International Association for the Study of Pain (IASP) accepted the term cervicogenic headache into its taxonomy, which defines headache conditions by their symptoms.(1) An obligatory symptom for cervicogenic headache

is unilateral headache of fluctuating intensity increased by head movement, while associated symptoms may include arm and shoulder pain and blurred vision.(2, 3) In the classification of headaches by the International Headache Society for both Category 2 tension-type headache, and Category 11.2.1 cervicogenic headache (1987), there is research supporting cervical involvement as a common origin.(4) It has been hypothesized by some that cervicogenic headaches originate from nociceptive structures in the cervical spine and are "reaction patterns."(2, 5) It is widely recognized that "dysfunctions of the upper cervical apophysial joints play an important role in regionally adjacent syndromes like headaches and also in relation to generalized dysfunctions of the entire human locomotor system."(6) Reliable diagnostics must be based on the patient's history, clinical findings, and relevant measurements. In this retrospective study, a single general practitioner diagnosed and referred 239 patients for possible treatment by manual vectored C-1 adjustment to a single National Upper Cervical Chiropractic Association (NUCCA) board-certified doctor. We report here the observations resulting from correction of the atlas subluxation complex on a subset of these patients with non-migraine headache.

Methods

Patients

Of the original 239 cases (referred between 1995-1997), 47 (29 female;18 male) of the 50 patients who were diagnosed as having non-migraine headache symptoms met the age range criteria of 18-65 years used in this study. The average age of the study population was 41.4 (SD, 11.3) years, while the average duration, or chronicity, of their headache symptoms was 9.4 (SD, 10.7) years. Records of the upper cervical chiropractor contained the patient's age, gender, symptoms, duration of symptoms defined by the referring physician, medical diagnosis, postural and x-ray measurements, visual analog pain scale data (VAS) to measure the average intensity of each of the major symptoms, short form 36 questionnaire (SF-36) results to evaluate the overall health related to quality of life, and extensive comments from the caregiver. Each of these metrics is described in greater detail below. All available data was used and reported. Records of the NUCCA chiropractor also indicate two major symptoms for each subject, with non-migraine headache being one symptom in all cases, cervical pain being the second most frequent (36%) symptom, followed by shoulder pain (15%) and vertigo/vision problems (11%).

Postural Measurements

The primary postural measurement is the functional or physiologic leg-length inequality (LLI). The physiologic/functional LLI is not an actual shortening of leg length and can be better described as leg length alignment asymmetry.(7) The LLI is determined by placing the patient in a supine, non load-bearing position and measuring the difference, if any, between the apparent lengths of the extended legs. The shorter of the two legs is sometimes known as the contractured leg. The LLI apparently results from over–innervation, or spastic contracture, of the extensor musculature.(8) There is agreement in the literature that any LLI of three-eights of an inch or more is both easily measurable and is correlated to the existence of C-1 positional disarrangement.The secondary postural measurement, pelvic tilt or Anatometer frontal plane (AFP), is taken using an Anatometer. The Anatometer is an instrument that measures and records postural distortion with the subject in a load-bearing, standing position. Stationary standing posture is usually defined in relation to a vertical line through the body's center of gravity that passes through most of the lumbar vertebral bodies and anterior to the thoracic vertebrae.(10) Seven postural measurements can be determined using an unmodified Anatometer. These include bilateral weight distribution, rotation of the pelvis in the transverse plane, tilt of the pelvis in the frontal plane, and angulation or tilt of the upper quarter of the body from the vertical.(11) In this study, only the tilt of the pelvis in the frontal plane was available for use. The pelvic tilt is the measured angular difference in degrees in the frontal plane between the oblique and the normal horizontal pelvic position. Both of these postural measurements, one in a load-bearing position and one not in a load-bearing position, are indicative of C-1 positional disarrangement, which is considered pathological by the upper cervical specialist.

All 47 referred subjects had postural distortion as measured by supine leg check; all 47 subjects had an Anatometer measurement indicating pelvic tilt. All 239 cases were referred to the upper cervical specialist by the medical practitioner based on the determination that LLI was present.

Radiographic Measurements

Based on the indication from the postural measurements that C-1 positional disarrangement was present, X-rays were taken on the new patient. The first X-ray taken is a lateral cervical view. Positional disarrangement of the cervical vertebrae in

this study can be seen in both the " exaggerated Town's" view, referred to here as the nasium view, and Reverse Waters view, referred to here as vertex view. The nasium and vertex views are used to determine atlas laterality and atlas rotation, respectively. These two measurements are measures of C-1 positional disarrangement and are used in the calculation of the direction of the vectored adjustic force.

Atlas laterality (ATL) is the angular frontal plane component of the positional disarrangement of C-1 resulting from an abnormal rotational movement or side slip of C-1 about the condyles of occiput and is measured off the nasium X-ray view. It is computed as the complement of the acute angle formed by the intersection of the central skull line, a line bisecting the skull and separating the skull into left and right halves, and the atlas plane line, a line below the posterior arch of the atlas. Atlas rotation is the transverse plane component of the positional disarrangement of C-1 resulting from abnormal rotational movement about the condyles of occiput and is measured off the vertex view.(12) Analysis of the upper cervical X-ray technique procedure used has been found to be both inter-examiner and intra-examiner reliable for both atlas laterality and atlas rotation and has been used in other studies.(13-15) Forty-seven ATL measurements were obtained from x-ray films taken pre-treatment and another forty-seven ATL measurements were obtained from outcome assessment x-rays taken immediately after the patient's first treatment. Twelve patients received more than one treatment based on the existence of measured postural distortion within the 120-day study period; these 12 patients averaged 2.66 treatments. The same vector for a given patient was used in their additional treatment if the postural patterns were the "same," that is, if the LLI of a given patient had the same leg contractured as on the initial visit and the Anatometer patterns were similar. The modus operandi of the vectored correction technique would suggest at least an additional post-nasium X-ray if the postural patterns had changed. If only the degree of a given pattern changed, then an additional X-ray would not be indicated by the normal standards of practice. In these 12 patients, only the degree of the pattern changed and therefore no additional X-rays were needed.(16) All 47 (239) subjects had ATL of three-quarters of a degree or more. Only this X-ray parameter was easily accessible for use in this study. It should be noted that functional LLI is always present when the cervical nasium radiograph indicates three-quarters of a degree or more of atlas laterality and thus is the primary screening measurement for determining the existence of C1 positional disarrangement by the NUCCA chiropractor.

All data was taken from the records of a single NUCCA board certified chiropractor (second author) who has an established practice based research (PBR) office. Using a NUCCA board -certified doctor addressed the difficulty in placing patients for plane radiographs, analyzing plane radiographs, and placing the patients in side posture with the correct head position for treatment. The authors agree with Mayer et al. that functional radiology is difficult.(17) This study also required that the NUCCA doctor be able to consistently deliver an accurate vectored manipulation resulting in at least 80% or better reduction in all postural measurements and proportionately in all cervical disarrangement factors measured from x-rays. Also, the practice had to have an informed "consent for research" process used routinely on all patients. [University of Toledo Biomedical IRB # 206-174 approval for "consent of research form" and for use of data for publication]

Patient Responses: Visual Analog Pain Scale

The visual analog pain scale (VAS) is a widely used psychometric pain assessment tool that is used to meaningfully quantify changes in pain intensity and is often used to measure differences in the potency and efficacy of various analgesics.(18) The VAS was used in this study to rate each patient's perceived level of pain on a 10 cm line. A 10 cm response corresponds to "the worst pain imaginable" and a 0 cm response corresponds to "no pain." Patients rated their perceived level of pain on initial presentment for two symptoms and again on each subsequent office visit before seeing the chiropractor.

Due to the lack of a formal control group inherent in many retrospective studies, it is often difficult to conceptually gauge the significance of the results. To help counter this difficulty, data from four other headache studies is used to construct a literature baseline for the VAS analysis.(19-22) In these four studies, both migraine and non-migraine groups are considered; however, only non-migraine groups from these studies were used to construct a literature baseline. Approximately half of the 291 subjects in the literature baseline group are diagnosed with tension-type headache, while the other half is diagnosed with cervicogenic headaches. In comparison to the pre-treatment baseline for the patients in this study, none of the demographic features of the literature baseline group are significantly different. Both groups are approximately two-thirds female and one-third male, both groups have similar age distributions with means of approximately 41 years of age, and both groups have similar perceived headache intensities as measured on the VAS scale.

Patient Responses: Short Form 36 Questionnaire

Medical Outcome's Short Form 36 (SF-36) questionnaire is a common metric to assess health-related quality of life. The SF-36 is composed of 36 questions designed to measure eight key areas related to health and quality of life by asking patients to recall their experiences within the previous four weeks.

Four of the eight categories, physical function, bodily pain, role physical, and general health, are used to examine specific qualities that define physical well-being. The other four categories, vitality, social function, role emotional, and mental health, are designed to assess different attributes of mental well-being. The SF-36 questionnaire was first administered to patients prior to initial treatment and was repeated within 90 to 120 days.

One of the key advantages of using the SF-36 is the availability of normative estimates for the 1998 U.S. population using a sample size of 5038 individuals. For all eight categories, the 1998 U.S. norms were re-centered so that each category has a mean of 50 and a standard deviation of 10. Scores higher than the normative values indicate a higher level of wellness, while lower scores indicate a lower level of wellness. These estimates, along with norm-based scoring algorithms, make the results from SF-36 measurement directly comparable to population estimates. In addition to normative estimates, a literature control group was compiled from SF-36 results presented in a study by van Suijlekom et al.(23) Both the literature control group and treatment group had approximately a 2:1 female-to-male ratio as well as similar age distributions with means of 44.63 years (SD, 12.91) and 41.38 years (SD, 11.29), respectively. Statistics on the chronicity of the headaches were unavailable for the literature control group. Both wellness and pain assessments were correlated to changes in postural and x-ray measurements and compared with data from other headache studies.

Results

Analysis of Postural Distortion Measurements and Radiographic Measurement

Table 1 shows the pre-treatment and post-treatment measurements of atlas laterality, leg length inequality, and pelvic tilt. Measurements of LLI differences in inches, pelvic tilt angular postural distortion in degrees, and ATL from the radiograph in degrees show a statistically significant change towards "normal" between the pre- and post- treatment.

Table 1 — Comparison of Postural Measurements and Radiographic Positional Measurement

Postural Measurements	Pre-Treatment Baseline	Post-Treatment	P-value ($\mu_1 > \mu_2$)
N	47	47	-
Leg Length Diff. (in.)	0.82 ± 0.30	0.01 ± 0.09	< 0.001
Pelvic Tilt (deg.)	3.22 ± 1.45	0.14 ± 0.27	< 0.001
Atlas Laterality (deg.)	1.79 ± 1.10	0.28 ± 0.40	< 0.001

Table 2 provides comparisons between the literature baseline and the pre-treatment baseline groups of non-migraine headache subjects. The sample population in this study was found to be similar to sample populations used in other studies containing non-migraine headache subjects with respect to both demographics and visual analog pain scale assessments. There was no significant statistical difference between groups by either age or VAS scores. Both comparison groups had roughly a 2:1 ratio of female to male. Chronicity was not available for groups that make up the literature baseline.

Table 2 — Comparison of Baseline Groups (VAS)

Feature	Literature Baseline(19-22)	Pre-Treatment Baseline	P-value ($\mu_1 \neq \mu_2$)
N	291	47	-
Female: Male	195:96	29:18	-
Age (yr)	40.97 ± 12.87	41.38 ± 11.29	NS
Chronicity (yr)	-	9.43 ± 10.74	-
VAS	5.57 ± 2.02	5.73 ± 2.37	NS

*NS = Not significant at 95% confidence level

Table 3 shows the VAS results for the primary symptom of non-migraine headache by utilizing paired and 2-sample t-tests comparing the pre-treatment baseline and post-treatment group and the literature baseline and post-treatment group, respectively. The VAS scores reported by the post-treatment group indicate a statistically significant reduction in perceived headache pain intensity post-treatment.

Table 3 — Comparison of Post-Treatment VAS with Baseline Groups

Feature	Literature Baseline(19-22)	Pre-Treatment Baseline	Post-Treatment	P-value ($\mu_1 > \mu_2$)
N	291	47	47	-
VAS	5.57 ± 2.02	5.73 ± 2.37	1.26 ± 1.49	$<0.001^{*}$, $<0.001^{\dagger}$

*Post-Treatment Vs Literature Baseline

†Post-Treatment Vs Pre-Treatment Baseline

Of the forty-seven records examined in this study, thirty-five of the individuals received only one treatment. These 35 patients had a total of 218 office visits (mean = 6.2 visits/patient) within the study period. A time series analysis was performed on the VAS scores related to headache pain of these thirty-five patients using VAS records from the first 150 days of treatment. The VAS scores were first normalized with respect to their score recorded on the day of their first treatment and each subsequent VAS score is represented as a percentage of their initial VAS score. A moving average on the normalized VAS scores was performed to eliminate high-frequency variance from the data. To ensure that the low-frequency trends were not influenced by the moving average, a sufficiently small period of about 5.05% of the total number of data points was used. A nonlinear regression technique was used to fit a decaying exponential function (base "e") of the form $y = a\exp(-bt) + c$ to the data. As can be seen from Table 4, the best-fit regression line explains approximately 90% of the variance in the moving average.

Table 4 — Time Series Analysis of VAS: Exponential Regression

Feature	Headache Group
N	35
Number of Applications	1
Number of Total Data Points	218
Averaging Period (%)	5.05
Analysis Duration (days)	154
Time Constant (days)	13.83
Asymptotic 95% C.I. (days)	(12.48, 15.50)
Steady State Value (%)	25.15
Asymptotic 95% C.I. (%)	(23.15, 27.16)
Coefficient of Determination (R^2)	0.90

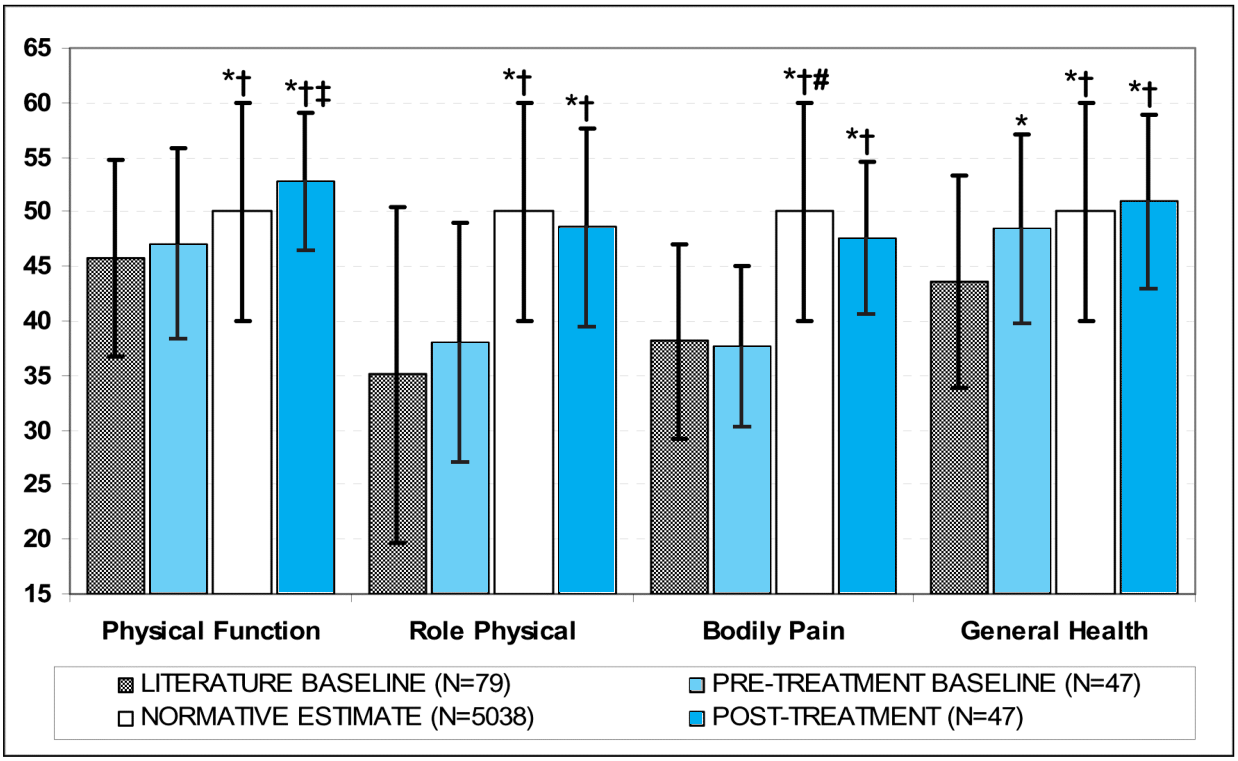
From the exponential expression, two important parameters were extracted, the time constant and the steady-state value of the decay. The time constant is defined as the reciprocal of the coefficient in the exponential term of the model ($\tau = 1/b$) and is a measure of the rate of decay in days. By definition, when one time constant has passed, the variable described by the model has decayed to 63.2% of its initial value. Since the data is normalized to the patients' initial VAS score, one time constant away from the start of their treatment marks a 36.8% reduction in perceived pain according to the VAS scale. Our model estimated the time constant to be approximately 14 days. The other parameter, the steady-state value (c), is an estimation of the level of decay given an infinite duration of time. The model predicts that there is ultimately a 75% reduction in the VAS score. Both parameters were estimated with an asymptotic 95% confidence interval. The confidence intervals are denoted as asymptotic because a linear approximation was used for the nonlinear fit, meaning that the given confidence is not exact. Asymptotic estimations for nonlinear models are often overly conservative in their given range.

Analysis of Short Form 36 Questionnaire

In addition to SF-36 questionnaire data collected in this study, data was taken from a previous study conducted by van Suijlekom et al. (23) in which SF-36 data was collected from patients with cervicogenic (N=37) and tension-type headaches (N=42). The data was then normalized in order to make it directly comparable to the pre-treatment baseline, post-treatment, and normative estimates. This literature-based control is subsequently denoted as the literature baseline.

Results for physically-related and mentally-related categories are given in Figure 1 and 2, respectively. For all eight categories, patients showed statistically significant improvement after 90-120 days of treatment. All eight categorical measurements for the pre-treatment baseline results are significantly less than the normative estimates, while most of the post-treatment categorical measurements are not significantly different from normative estimates. In comparison to the literature baseline, the post-treatment results show significant improvement across all eight categories. These results indicate a significant improvement in the patients' health-related quality of life as measured by the SF-36 questionnaire. Furthermore, the results from the bodily pain category demonstrate significant improvement at the same confidence level as the VAS pain measurements.

Figure 1 — Comparison of the SF-36 Physical Categories



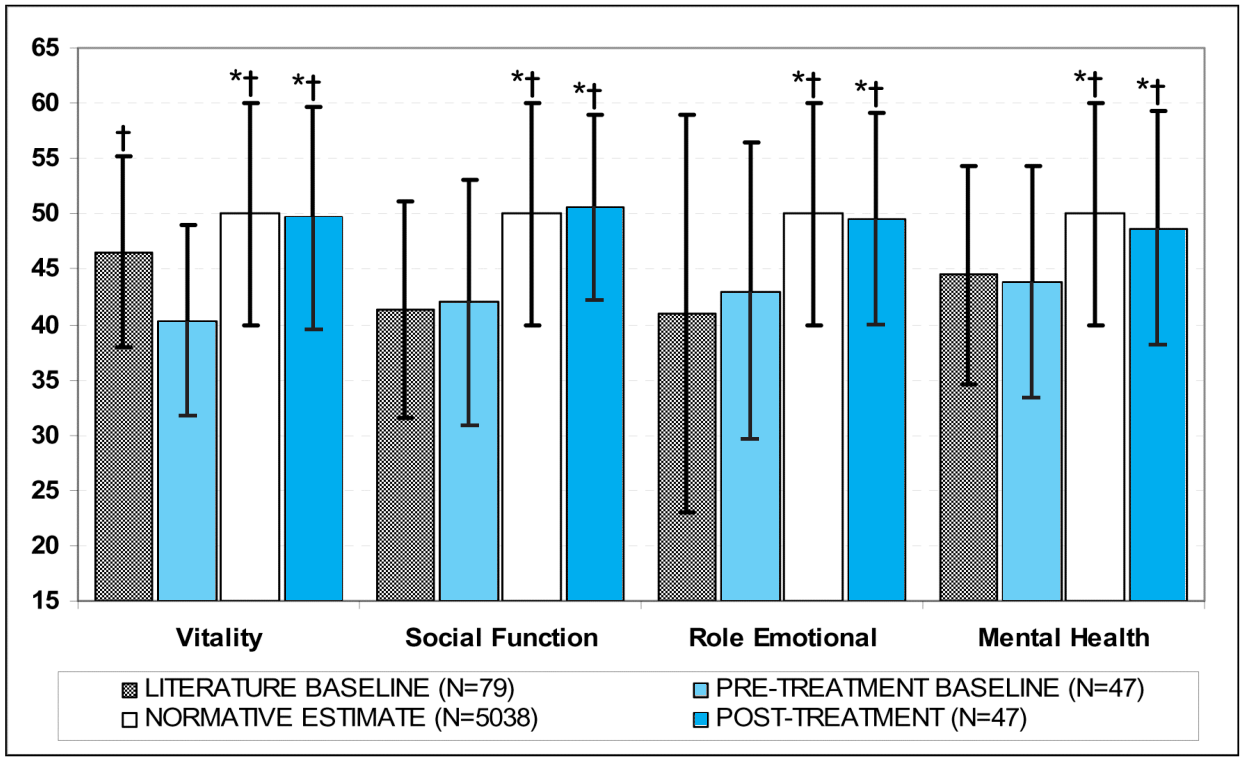
*Greater than literature baseline[23] (P<0.05)

†Greater than pre-treatment baseline (P<0.05)

‡Greater than normative estimate (P<0.05)

#Greater than post-treatment (P<0.05)

Figure 2 — Comparison of the SF-36 Mental Categories



*Greater than literature baseline[23] (P<0.05)

†Greater than pre-treatment baseline (P<0.05)

‡Greater than normative estimate (P<0.05)

#Greater than post-treatment (P<0.05)

Analysis of the VAS scores relating to the second set of major symptoms, those other than non-migraine headache pain, showed improvements similar to those observed by VAS scores relating to average headache intensity. However, since the SF-36 scores are not symptom-specific, the improvement in quality of life is confounded by multiple symptoms and cannot be solely attributed to the reduction of headache symptoms by the treatment. This study did not address that some patients may have coexisting headache disorders, possibly both cervicogenic- type and tension-type headaches.

Discussion

Various modalities for treatment of headache, including non-vectored cervical manipulation, have been around for many years.(24-27) Manual vectored forces used in this study are in the range of 30-100 Newtons and are characterized as having small velocity, impulse, and depth and producing small displacements. This implies that small increments of energy are being transferred indirectly into C-1 with the patient being unaware of C-1 movement. The authors believe this manual vectored approach to be the least invasive of all "manipulative" approaches because of the relatively small force magnitudes necessary to overcome the resistance of the cervical disarrangement, the control of the direction of the force, the ability to use the resistance of the cervical disarrangement to set the magnitude of the force needed for movement of C-1, and the potential to limit the frequency of intervention. The NUCCA chiropractor in this study (second author) typically administers only 1-3 interventions (triceps pulls) or contacts per treatment; this is unique among NUCCA board- certified doctors.

This study is different in many respects from previous studies: no manual palpation, no range of motion in flexion and extension, no large force, a vectored force, no blood work, and no mobilization, to name a few. Major review articles did not have literature overlapping the unique elements of this study even though the medical profession has been active in cervical

spine research for at least fifty years.(28-34) To the author's knowledge this is the first study using pre-2000 data that used (1) both diagnosis and postural screening for LLI by a medical doctor for selecting a population with C-1 involvement and then referring the population to an upper cervical chiropractic specialist, (2) a time series analysis on the effects of a single specific orthogonal upper cervical treatment on any type of headache for more than a single patient, and (3) correlations of non-migraine headaches, which are believed to be cervicogenic, with posture, x-ray measurements, and standard pain and wellness instruments.

From a population of 239 patients, 50 were diagnosed with non-migraine headache and 47 met the normal literature age range of 18-65. The medical diagnosis of non-migraine headache all but eliminated the possibility of migraine without aura. We found that all 50 non-migraine headache patients had C-1 positional disarrangement based on meticulous cervical X-ray and patient positioning processes. The authors do not suggest that all non-migraine headache patients have postural asymmetries or C-1 disarrangement; we do suggest that if postural asymmetries do exist, then the probability is that patients diagnosed with non-migraine headaches have C-1 positional disarrangement. In pain clinics, cervicogenic headache occurs in 33.8% of headache patients; this statistic when coupled with the second set of major symptoms and comments from the caregiver support the assumption that a significant fraction of the subjects experienced cervicogenic headaches.(35) However, the sheer prevalence of tension-type headache in the general population (78%) and the absence of a rigorous differential diagnosis by either the referring physician or the upper cervical chiropractor do not exclude the possibility that a small fraction of the subjects may have experienced a tension-type headache with bilateral complaints.(2, 5, 6) Literature supporting that non-vectored manipulation was more therapeutic to cervicogenic headache than to tension-type headache supports the supposition that the predominant group had cervicogenic headaches.(36) Misalignment of atlas determined from X-rays and head tilt and other postural distortions all strongly suggest a preponderance of cervicogenic headache.

Because the preponderance of the non-migraine headaches in this study appears to be cervicogenic, the authors suggest that C-1 positional disarrangement could be a sufficient reason to suspect cervicogenic headache in non-migraine headache subjects.

It should be noted that a significant fraction of all patients with C-1 disarrangement as determined by LLI have an "awkward head position." The body, including the head and neck, tries to compensate for being off the vertical by righting itself. It seems well established that C-1 disarrangement can be caused both superior and inferior to C-1. A recent study used malocclusion to induce a scoliotic curve at T1 "probability related to the consequential tilt of the first cervical vertebrae (C-1) which affects the tilt of adjacent vertebra, destabilizing the vertical alignment of the spine." (37) Instead of anterior lean of the upper quarter of a body in the sagittal plane, this study supports postural problems at the level of the pelvis in the frontal or coronal plane.

In this study, the geometry of X-ray tube, patient, and film distances translates three-quarters of a degree or more of atlas laterality into a corresponding 0.17 mm or more on the nasium plane radiograph. Whereas the preponderance of previous studies assesses the mobility or hypomobility of the intervertebral cervical joints in the sagittal plane as described by Mayer et al., the upper cervical measurement process used in this study was based on the frontal or coronal plane static view via a nasium X-ray to determine atlas side shift around the condyles of occiput. The upper cervical specialist who participated in this study has viewed well over forty thousand nasium X-rays in over fifty years of practice and has improved on all phases of the radiological examination including patient placement for X-rays, marking of patients for structure location, sophisticated patient shielding to lower patient dose, and development of internal measurements checks.

The authors are also aware, based on research by J.A. van Suijlekom, that the inclusion of an expert headache neurologist for differential diagnosis would be preferred.(5) The obligatory criterion for cervicogenic headache, unilateral headache of fluctuating intensity, was not recorded by the chiropractor and records from the medical doctor were not available. Most of the literature is confounded by multiple approaches and multiple skill levels.(5, 38, 39) In this retrospective study, information such as medication used, frequency of attacks, precipitating factors, and ameliorating factors were not available. Future research will involve a headache neurologist to diagnose the headache type and monitor the progress of the patients under treatment.

The purpose of this study was not to address possible physiological causes or etiology of non-migraine headache or to test current theories, but rather to provide an original approach that may suggest some possible avenues for headache research that may lead to a more robust etiology of C-1 involved headaches.(31, 40-43) The 189 patients who were not diagnosed with non-migraine headaches all had postural LLI and had X-ray measured C-1 positional disarrangement and presented

a variety of medically diagnosed symptoms such as sciatica, lumbar pain, TMJ, and migraine headache (n = 4). Almost all had approximately equivalent results with manual vectored adjustment at C-1. This suggests that the entire upper cervical process has a high degree of efficacy and usefulness not readily found in the literature and appears to suggest the involvement of the autonomic nervous system.(44) A recent study using the same protocol by the same NUCCA specialist shows achievement of arterial pressure goal in hypertensive patients.(45)

This retrospective study was performed on data collected through practice-based research. Practice based research (PBR) has many advantages and disadvantages. Of primary disadvantage is an absence of a control group and of "blinding". One cannot afford to give placebo "manipulations" resulting in patient complaints in practice. No insurance company would want to pay for a placebo manipulation. Few patients would want to be part of an experiment in which their time and money is considered wasted. At best one can only use studies from the literature to serve as the "non-treatment group".

Another consideration and potential problem in PBR is how to handle patient spacing if the number of patients with a given symptom is relatively small. Small for PBR may be more than adequate for designed experimentation. For example, the high-frequency variance observed before applying the moving average on the time series analysis could be attributed to the fact that the intervals between visits, and thus reported VAS scores, are irregular across the thirty five patients. It could also be a result of normalizing a wide variety of VAS scores to the same scale. Patients with extremely high initial VAS scores may best fit different exponential models from those with low initial VAS scores since they may report different relative reductions in pain levels.

It should be apparent that publication of PBR requires different literature criteria than traditional research. The only other reasonable way to directly make comparisons in PBR is to compare with other PBR results of the same or different technique. There is no way to know without double- blinding if these patients would have shown equivalent results had they not been adjusted.

One can, however, possibly begin to argue on the basis of the chronicity of headache symptoms of the patients before treatment that these observations are significant. When coupled with data from pre-treatment X-rays and outcome assessment X-rays and with both pre-treatment and post-treatment load- bearing and non-load bearing postural measurements (changes) being positively correlated, it seems unreasonable to not accept that biomechanical and neurological changes did take place. Certainly the authors do not believe that the subjects from this study somehow were talked into a lessening of pain (VAS) or an attitude change (SF-36). The authors do not believe that common biases such as regression to the mean, natural history of headache, placebo effect, and confirmation bias, have anything more than minimal effect and therefore do not compromise the external validity of the study findings.

Practice based research also has many advantages. PBR illustrates what is done in practice and in that sense it explains why chiropractors have patients and why they are able to build their practice. It is the continuous quality of care and its effectiveness that the most important critic- the patient himself- upon which the decision to remain under care is actually made. It is the basis of the demand by the public that provides chiropractic colleges a reason to exist.

The NUCCA modus operandi of manual vectored- adjustment utilizing both pre-adjustment X-rays taken on new patients for assessment of pathology and biomechanics and outcome assessment X-rays for establishing any future baseline is shared by other upper cervical techniques such as Orthospinology and Atlas Orthogonal. NUCCA however has been the leader not only in establishing the importance of body posture as evidenced by the development of the Anatometer but also in discovering, defining, and interpreting X-ray in- pattern and out-of-pattern biomechanical misalignments of the upper cervical spine. Both body- posture patterns and X-ray misalignment patterns have been found to persist in the absence of trauma if left uncorrected. (46)

The authors take issue with the purported behavior of editorial staffs in some chiropractic related/dominated publications which apparently reject studies or are at least less favorable to publication of these studies because they have used outcome assessment x-rays on new patients; certainly, as is the case in this study, if an IRB made up of more than a dozen medical doctors can approve outcome assessment x-rays and pre-treatment X-rays, then no editor should find X-rays to be a problem whether or not the study is retrospective. It is just such an X-ray protocol that shows that chiropractic can have more than a symptom-based outcome; it is just such a repeatable chiropractic protocol due in part because of X-rays that chiropractic should embrace the efforts.

Conclusions

Manual vectored adjustment of the atlas by an upper cervical chiropractic doctor using an orthogonally-based analysis system may be a possible analgesic for non-migraine headaches and may be the most appropriate single procedure in which to address cervicogenic headache. Leg-length inequality taken with the patient in a supine position may be the easiest postural measurement by which to address neurological insult to the C-1 area and also may be helpful in making a more robust differential diagnosis in future headache studies and in upper quarter conditions in general. The process of initial postural screening and diagnosis of non-migraine headache by the medical physician serving as the primary care provider leads, upon referral, to significant positive correlations with posture, x-ray measurements of both C-1 and cervical disarrangements involving other vertebra, and standard pain and wellness instruments. The potential to successfully screen non-migraine headache subjects for referral based on posture and to have that referral meet with a high level of success is important to health care. The apparent effectiveness of a single treatment session using manual vectored adjustment at C-1 is provided by the time-series analysis of VAS measurement and provides a target for measuring the relative practice based effectiveness of the hundreds of other techniques. The authors believe that practice based research is the most reasonable way in which doctors can judge the effectiveness of what they do day in and day out. PBR will promote the advancement of chiropractic practice skills and increase the pool of inclusiveness.

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(Biomedical IRB# 206-174).

Marshall Dickholtz Sr. is the ICA Chiropractor of the year 2008, a past- recipient of both the D.D. Palmer Scientific Award and the R.R. Gregory Award, and past-president of the Upper Cervical Research Foundation.

The principal author takes full responsibility for the data presented in this study, analysis of the data, conclusions, and conduct of the research. The principal author had full access to those data and has maintained the right to publish any and all data independent of any third party.

Occupation Analysis on Non-migraine Headache Pain in a Retrospective Practice-based Research Headache Study

James Palmer, J. Cord Palmer, Marshall Dickholtz Sr.

(Editor's Note: The Visual Analog Scale [VAS] was used in the study to rate each patient's perceived level of pain on a 10cm line. A 10cm positioned- response corresponds to the "worst pain imaginable" and a 0cm positioned- response corresponds to "no pain". Patients rated their perceived level of pain on initial presentment for their primary symptoms and also their secondary symptoms and again on each subsequent office visit before seeing the chiropractor. Myles ET. al. (Anesth Analg 1999; 89:1517) tested the validity of using a 0-10 VAS scale as a psychometric pain assessment metric. They concluded that "a change in the visual analog scale score represents a relative change in the magnitude of pain sensation. Use of the VAS scale in comparative analgesic trials can now meaningfully quantify differences in potency and efficacy". A more thorough study would involve "minimal clinically important difference" [MCID] and "minimal detectable change" [MDC] at some confidence level. It should be noted that in the study cited post-adjustment VAS values were essentially equivalent to general population baseline values.)

On June 4, 2009, in the Journal of Vertebral Subluxation Research (JVSR) an original research article titled, "Improvement in Radiographic Measurements, Posture, Pain, & Quality of Life in Non-migraine Headache Patients Undergoing Upper Cervical Chiropractic Care: A Retrospective Practice Based Study" by J. Palmer & M. Dickholtz, Sr. (pp 7-18) left unanswered the question, "Did the occupation of the patients affect the level of reduction in pain intensity as measured by the VAS scale?".

To address that question the authors requested that a sub-analysis be conducted by the statistician (J. Cord Palmer) to determine whether the relative amount of physical activity required by the patients' occupations played an important role in the intensity of their pain or in the progression of their treatment. A physical intensity rating of low is typical of jobs that require the employee to work full-time at a desk. Medium intensity denotes some variation in physical intensity and often includes jobs that require the employee to be standing. Finally, jobs with a high physical intensity rating involve varying degrees of manual labor. The results of this sub-analysis are shown in Table 5.

Table 5: Breakdown of Pre- and Post-treatment VAS by Physical Intensity of Occupation

	PHYSICAL INTENSITY OF OCCUPATION			
FEATURE	LOW	MODERATE	HIGH	P VALUE ($\mu_1 \neq \mu_2 \neq \mu_3$)
N	21	18	8	
VAS Pre-treatment	5.69 ± 2.47	5.39 ± 2.24	5.75 ± 3.52	NS
VAS Post-treatment	1.43 ± 1.35	1.57 ± 1.88	0.38 ± 0.61	NS
P Value ($\mu_1 > \mu_2$)	<0.001	<0.001	<0.004	

NS= Not significant at 95% level; μ= arithmetic mean

An ANOVA analysis showed that the pre-treatment and post-treatment VAS scores of the three sub-groups are not statistically different at a 95% confidence level. Results from paired t-test between the pre-treatment and the post-treatment for each of the three sub-groups are shown on the bottom row of Tasble 5. All three sub-groups showed a significant reduction of perceived headache intensity as measured by the VAS scale at least at a 99.6% confidence level.

NUCCA Technique/Hypertension Pilot Study: A brief history

Marshall Dickholtz Sr.

THE IDEA

The beginnings of the hypertension study can be traced back to 1968 when Bruce Bell, a medical doctor in Barrington, Illinois, first discovered the effectiveness of adjustments on several of his patients by my use of the National Upper Cervical Chiropractic Association protocol (NUCCA technique). Over the next 25 years, Dr. Bell referred more than six thousand patients to my Chicago office. In time, Dr. Bell realized that 32 of the problems seen in his referred patients that were successfully addressed by the upper cervical procedure, were autonomic in nature. One of these problems was hypertension.

Dr. Bell contacted Dr. George Bakris, an MD who, at the time, was at Rush Presbyterian St. Lukes, one of Chicago's largest teaching hospitals. (Today Dr. George Bakris is director of the hypertension clinic at the University of Chicago's Pritzker School of Medicine.) Dr. Bell was able to get Dr. Bakris to head a pilot study, the protocol of which was subsequently submitted to and approved by the Western Internal Review Board. To fund the pilot study, Dr. Bell spearheaded the formation of the Barrington Atlas Research Corporation – now known as the Atlas Research Foundation – and enlisted business professionals such as George Schueppert, Norval Stephens, and Keith Hanson as directors.

THE VISION

Dr. Charles Woodfield, who is now in the research department of Parker College of Chiropractic realized that the study had to be exceptionally well done to appear in The Journal of Human Hypertension, the third most prestigious medical journal focusing on hypertension. To that end, only patients who had Level I hypertension, a short or contractured leg, and had no pain were recruited into the study. The criterion of "no pain" was critical because, if there was pain, then potential critics could argue that blood pressure dropped because pain was alleviated. In addition, that criterion of "no pain" also concurrently placed these patients out of the mainstream chiropractic paradigm that focuses on spinal manipulation, range of motion, and site of pain. If there is no site of pain, then where would mainstream chiropractic adjust? (What percentage of your new patients have no pain?)

The short or contractured leg is a necessary criterion in diagnosing the existence of a C-1 misalignment. NUCCA protocol only requires postural distortion for a person to qualify as a new patient; pain is not a necessary symptom. Using Level I hypertension patients ensured that patients were not that far removed from the blood pressure of the normal "healthy" population and provided an additional level of safety when removed from medication. All of the subjects in the study came from the practice of Dr. Bell.

THE STUDY

The original 50 subjects, in the study, were randomly divided into two groups of 25 each. The control group received a placebo "adjustment." This was possible for two basic reasons: 1) because the "adjustment" is so light and 2) because the head could be braced and the adjustment vector controlled so well that no measurable change would take place in the misalignment.

The treatment or experimental group received an equally light adjustment but the vector used and the head placement were specific for each subject based on NUCCA's "understanding" of the presenting biomechanics as interpreted from X-rays for that particular patient. Patients were blinded as to whether or not they had received the sham "adjustment" or had received the real adjustment. The nurse taking the blood pressure readings was not aware of which subjects had been given the real adjustment. Hence, in this sense only, the pilot study was a double-blind study. With regard to posture measurements, X-rays, and adjustments the chiropractor was, of course, not blinded.

Posture measurements in this study included both supine leg check (non-load bearing) and standing (load-bearing) pelvic inclination (frontal plane) as measured on the anatometer as well as bilateral weight distribution, pelvic distortion in the transverse plane ("rotation") and lateral displacement of C-7 off a vertical axis. A laser light system was used to make measurements more readable. All patients were blindfolded for anatometer measurements and a digital camera recorded the posture of all 50 participants.

A standard cervical X-ray series was used and this consisted of lateral, nasium, and vertex views. Lead filters helped to minimized exposure to individuals. Atlas laterality and atlas rotation were measured and used in the calculus for determining the adjustic vector.

Three time events were of critical importance in measurement. Just before actual adjustment, just after adjustment, and eight weeks after adjustment; this sequence was identical for the placebo group. All patients had been off their medications two weeks prior to adjustments and randomization. All patients had all measurements taken at each of these three time events. In addition, all patients had blood pressure measurements taken weekly for eight weeks.

THE RESULTS

Of the 25 subjects in the treatment group, 15 had an average systolic blood pressure drop of 28 mm of Hg relative to the placebo group while the other 10 did not basically change. The treatment group (n=25) therefore had an average of 17 mm of Hg drop. Twenty-one patients had only one adjustment during the study. Future research will take a close look at why one portion of the treatment group (n=15) responded and the other portion of the treatment group (n=10) did not respond in a lowering of systolic blood pressure.

Papers are being written for publication by Dr. Woodfield, with partial financial support from the Upper Cervical Research Foundation (www.ucrf.org), showing that the VAS scores were basically "zero" for both the control and the treatment groups throughout the study, and that for the treatment group the SF-36 scores improved in all eight categories of well-being.

The NUCCA Technique is taught at Palmer College as an elective and is in the curriculum at Life Chiropractic College West. Canada has about three dozen NUCCA doctors. The hypertension article appeared in the Journal of Human Hypertension (May 2007) under the title: Atlas vertebrae realignment and achievement of arterial pressure goal in hypertensive patients: a pilot study.1 Additional information in supporting future research can be found by going to www.ucrf.org.

Many thanks to Professor James Palmer for editing this article.

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1) Bakris, G., Dickholtz M. Sr, et al. Atlas vertebrae realignment and achievement of arterial pressure goal in hypertensive patients: a pilot study. J. of Human Hypertension, May 2007, 21(5): 347-52. Currently practising in Chicago, Illinois, Dr. Dickholtz Sr. has been in practice for 51 years. He is a former president of the National Upper Cervical Chiropractic Association (NUCCA) and the lead researcher for NUCCA. Dr. Dickholtz is a recipient of the Daniel David Palmer Scientific Award, the R.R. Gregory Award and chiropractor of the year of the Illinois Prairie State Chiropractic Association in 2007. For additional information regarding this research project, you may contact Dr. Dickholtz at 773- 267-0020 or 847-677-7253, or visit the website www.nuccadickholtzsr.com.

Continued on page 22

OF NOTE: ATLAS ALIGNMENT AND THE NEED FOR X-RAYS

One of the significant observations in the study was that when placebo-group subjects were carefully placed in position for X-rays at all three time events, atlas laterality and atlas rotation measurements were constant; in the treatment group the atlas laterality and atlas rotation measurements were constant in the post adjustment phase. In conclusion, if the patient placement is the same, then the measured misalignment on X-rays is constant over time; if the correction holds, then the X-ray listing – set of measurements – is constant over time. (125 sets of X-rays are involved in these constant-over-time measurements.)

This is not necessarily saying that the atlas is locked in position; it is certainly not locked in flexion or extension. When coupled with other research, these observations are consistent with the hypothesis which suggests an abnormal set of "locked-in" paths for a misaligned atlas and a normal set of "locked-in"paths for an aligned atlas for a subject moving their head and neck. (One can see on X-rays other parts of a given path for both cases of aligned and misaligned upper cervicals, if the patient placement is not consistent!) What this does support is the validity of using X-rays for determining a vector for adjustment if, and only if, the practice protocol requires consistent patient placement for X-rays. If the misalignment were different on every day of the week, even when the same patient was consistently positioned, then one could relatively easily argue for a random vector, or for no "known vector," to be used in a spinal manipulation. Thus X-rays for determining a vector would not be necessary – unless only the vectored alignment process consistently resulted in a correction that held over a reasonable time period.

Of even more importance is that an aligned set of upper cervicals is found to be in alignment over time. If the time frame for maintaining alignment were only on the order of a day or two, then the chiropractor would have to be doing spinal manipulations several times a week. Certainly it would be prohibitive to the health of the patient to X-ray each visit. (In-house research has shown that any remisalignment tends to be in the same pattern – basic type – over time.)

It is important to understand that there is only a very small range of neurological alignments possible – one necessary requirement is that atlas laterality be less than 0.75 degrees – whereas there is a very large range (orders of magnitude larger in number) of neurological (and biomechanical) misalignments possible.

A Brief Look at Biedermann et al., and the "KISS" Syndrome.

Michael Thomas

There is a developing body of literature on treatment of the upper cervical area (primarily in infants) that comes to us from Biedermann and others (Gutman, etc.) in Europe. This body of work virtually constitutes a parallel system of upper cervical 'adjustment' (manipulation) developed over several decades that seems to be essentially separate from either the articular or orthogonal approaches developed in a similar (although initially earlier) time frame in North America. Important similarities and differences exist.

Biedermann, in a summary of his work in 1992, noted that the craniovertebral junction in newborn and young babies can be the site of a syndrome of problems that he termed "kinematic imbalances due to suboccipital strain" or KISS. He detailed a wide variety of clinical signs and symptoms which have responded well to manual therapy. The main signs of KISS being torticollis, unilateral microsomy, C-scoliosis, motor asymmetries, unilaterally retarded maturation of hip joints, and slowed motor development. Etiological factors include intrauterine misalignment, application of extraction aids, prolonged labor and multiple fetuses.(1)

Biedermann has brought a variety of functional disorders and symptoms into his KISS concept. As he notes:

"The definition of a functional disorder that is caused primarily vertebrogenetically enables pediatricians, physiotherapists, speech therapists, and others to widen their scope of available therapeutic options and to include the "functional approach" in their therapeutic considerations." (2)

Functional Medicine is growing in influence and has the potential to become a potentially guiding force in medicine here in the United States. (3) Biedermann's approach is consistent with the functional model. Functional indications that the KISS syndrome may be present include: Tilt posture of the head, torticollis, opisthotonos, uniform sleeping posture (baby cries if mother tries to change the posture), asymmetric motor patterns, asymmetric posture of trunk and extremities, sometimes combined with a tilting head position reminiscent of a persisting asymmetric tonic neck reflex, sleeping disorders (baby awakens every hour crying), extreme sensitivity of the neck, cranial scoliosis (swelling of facial soft tissues on one side), blockages of the iliosacral points, asymmetries of the gluteal muscles, asymmetric development and range of motion of the hips, fever of unknown origin, loss of appetite and other symptoms of central nervous system disorders. Other examination findings include: C-scoliosis, mobility of the vertebral spine reduced by more than 30%, feet deformities, pathological reflexes.(4)

Biederman has further subdivided his syndrome into two basic types. KISS I is defined as a fixed lateral flexion posture and KISS II is defined as primarily a fixed retroflexion posture. These postures involve the entire body of the infant. KISS I clinical markers include *"torticollis, unilateral microsomia, asymmetry of the skull, C-scoliosis of neck and trunk, asymmetry of gluteal area, asymmetry of motion of the limbs, retardation of motor development of one side."*(5) Clinical marker for KISS II include: *"hyperextension (during sleep), (asymmetric) occipital flattening, shoulders pulled up, fixed supination of the arms, cannot lift trunk from ventral position, orofacial muscular hypotonia, breast-feeding difficult on one side"*(6)

Primary indications of the presence of KISS include asymmetry of posture and movement. Hypersensitivity and restricted range of movement in the suboccipital structures should, Biedermann argues, result in referral of the infant to a 'specialist'. (7)

Biedermann also has defined a KIDD syndrome. It was noted over time that infants often recovered when they began to verticalize, which is a term Biedermann uses for the various maturation processes in which infants begin to get upright in preparation for walking. It was found that the differentiation between KISS I and KISS II *"loses its meaning after verticalization, as the influence of the upright stance modifies the basic conditions to such an extent that the fixed posture is almost abandoned."* (8). The second to fourth years are perceived as a 'silent' period when few problems are noted. From the fourth year to preadolescence, a variety of problems can occur including:

"imbalance of the muscular coordination with asymmetrical tonus of the postural muscles, shortened hamstrings, kyphotic posture with hyperlordosis of the cervical spine and hypotonus of the dorsal muscles of the thoracic area, often accompanied

by orofacial hypotonia; scoliotic posture in sitting/standing position; shoulders at different height; sacroiliac(SI) joint mobility asymmetrical often with asymmetry of leg rotation; balance tests insufficient and mostly asymmetrical; insufficient coordination of vestibular input, e.g. standing with raised arms and closed eyes difficult; acoustic orientation laborious; locating the source of an 'interesting' noise difficult; combination of arm and leg movements difficult, e.g. jumping-jack test; fidgeting and restlessness, sometimes tics; using eye control to compensate for lack of proprioception, refusing to lie down supine, clinging with one hand to the examination table; decompensation when the close range is invaded by the examiner; wild resistance against palpation."

Biedermann's protocol to define KIDD looks at four components:

"a case history with the relevant KISS symptoms during the first year; asymmetry of posture and movement during examination; a sufficient number of symptoms from the list above; the palpation of restricted movement to palpation in the suboccipital area."(9)

Biedermann notes that the primary symptom causing parents to bring children in is headache. There is advice to adjust these children in both the cervical area and also possibly in the sacral area. Biedermann notes a multitude of behavioral type therapies that can be helpful but notes they often have to be repeated with some frequency. He finds that manual therapy usually doesn't have to be repeated as often and he doesn't usually follow up more than once a year. (10)

Biedermann writes that Gutman, before him, looked at the upper cervical area as a cause of 'pathogenetic significance". (11) He writes:

"As early as the 1950s and 1960s Gutmann published cases of what he called Atlas blockage syndrome.(12) *He drew attention to the pathogenetic significance of the cervico-occipital junction. However C1 is not the only culprit and we cannot be certain to find a morphological substrate for a "blockage" in these immature soft joint tissues. We prefer to use the term kinematic imbalances due to suboccipital strain (KISS syndrome). It is well defined by well-defined clinical symptoms and anamnestic facts and its diagnosis gives the experienced effective access to a wide range of problems."* (13)

Biederman finds the birth process to be a greatly undervalued cause of trauma. He points out previous studies revealing a high percentage of microtrauma in the periventricular areas of the brainstem.*(14)* He also discusses the probability that the structures that lie exposed under the cranium suffer at least as much from traumas (such as the birth process) as the cranium. (15) In fact this has been shown in studies regarding the biomechanical forces involved in delivery.*(16)* Biederman writes that injury at birth may be the norm rather than the exception. He further credits the incredible ability of the developing nervous system to overcome these traumas and repair much of the damage.*"(17)*

Biedermann utilizes what he terms, *"functional and morphologic analysis of the "classic" radiographs of the cervical spine."* (18) He reports *"If the desymmetrization of the occipito-cervical junction follows the established pattern...the direction of the impulse is confirmed."* In his examples, a KISS I (A-P open mouth) radiograph showed what seems to be right laterality and a whole body lateral flexion to the right, including the right head tilt, somewhat similar perhaps, to our idea of a right type II. Biederman apparently uses Gutmann's protocol to x-ray the infants which is this A-P open mouth film. There does not seem to be any attempt to radiographically measure rotation in the transverse plane. Biedermann however does seem to reject the idea that it is possible to accurately and objectively measure misalignments the way we do in orthogonally based upper cervical work. His analysis encompasses more than measurement of the osseous structures although he does state:

"Selection of the direction of the treatment without radiographs seems the most plausible cause for the less encouraging results of some colleagues."(19)

Biedermann references Gutman (20) when discussing the films taken. There are oblique references to 'the classical techniques" and it appears that at least a lateral and AP open mouth film are taken. He is also advocating taking full spine pictures too because that enters into his analysis. There does not seem to be any visualization of the transverse or axial plane in the analysis of the cranio-vertebral junction. He mentions MRI and other imaging techniques that might be used, but the application seems more to be 'art' and clinical experience in regard to the axial plane.

If the x-rays and symptoms are in agreement, Biedermann uses the x-ray findings to direct the line of drive for manipulation. He reports this occurs about 80% of the time.

"In those 20% of the cases where there is no match between radiological and clinical picture one has to be especially alert to find other discrete signs which might help to explain this discrepancy. It is not always possible to come to a completely satisfactory explanation for this discrepancy but in most of these cases a central neurologic component is present." (21)

Biedermann comments at some length on the emotional and scientific issues revolving around radiating patients. He notes that fetuses and children are about twice as sensitive to radiation as adults but no more so. He challenges the linear response curve that is usually regarded as the standard for damage from radiation which states that damage is proportional to dose, no matter how small the dose. He adds that the dosages for cervical films on infants is one of the lowest dosages used in conventional radiology. For him the risk-benefit analysis "*clearly favors the standard procedure of taking radiographs before any treatment of the cervical spine regardless of the age of the patient."(22)* Even without the primacy of orthogonal analysis, Biedermann clearly sees the necessity of taking films before adjusting and sees no contest in terms of risk and benefit.

Apparently somewhat aware of the work done over the past century in chiropractic and osteopathy (or at least their origins) Biedermann finds little to help him there. Although he invokes the names of Palmer and Still, he writes that although they had both remarked about the damage early traumas can create in development, there had not been given any specific signs that would illustrate this damage. Therefore this early insight wasn't, in Biedermann's opinion, able to be practically applied at the time. (23)

Biedermann is convinced that the results of this work on infants far surpasses anything that is possible in the adult and cautions the reader not to assume that the reader's experience of manipulation in the adult population is comparative to MTC (Manual Therapy in Children). An infant is in an extremely active phase of rapid growth and maturation. The many osseous growth centers are very active and postural distortion from upper cervical misalignment creates structure that is asymmetrical and potentially less (or mal-) functional. This fundamentally changes the maturation of the structure of the body. It is only at this early period that he believes real and permanent changes can be made that will affect the entire life of the individual. He notes:

"Manual therapy in children bears only scant resemblance to the much less dramatic and well-known effects we see in adults. We are aware that we often repair without being able to heal, thus condemning both therapist and patient to repeat this exercise sooner or later." (24)

As Dr. Scholten recently noted after speaking with Biederman, our concept of upper cervical work is that we are able to restore alignment to the osseous structures as they relate to each other. The power of this procedure is well known to us. Biedermann however, is more interested in working very early in life so that the discrete osseous structures themselves are formed properly (symmetrically). Biederman sees (mal)function (KISS) affecting developing structure in the infant and young child. Considering that most afferent proprioceptive signals come from the craniovertebral junction, any interference to normal signal flow will have extensive impact on the developing nervous system, much more than at any other time in life. This has obvious importance throughout the entire lifespan of the individual. As this developing structure is then laid down asymmetrically (due to postural distortion), it causes potentially permanent structural issues that can continue to cause problems through the whole lifespan. Biedermann sees that in the early months of life, function therefore affects structure. Once the structural development has been laid down, structure will affect function for the rest of the lifespan. It is in these early months that Biedermann sees such outsized potential for phenomenal results. (25)

In discussing the further maturational difficulties that can ensue due to upper cervical misalignment (our term):

"Traumatization of the suboccipital structures inhibits functioning of the prioprioceptive feedback loops. The motor development, though preprogrammed, cannot develop normally. These systems are fault tolerant and able to overcome considerable difficulties and restricted working conditions. But the price for this is a reduced capacity to absorb additional stress later on. These children may show only minor symptoms in the first months of their life e.g., temporary fixation of the head in one position, and "recover" spontaneously. Later on- at the age of 5 or 6 – they suffer from headaches, postural problems or diffuse symptoms like sleep disorders, being unable to concentrate, etc." (27)

Biedermann thinks that the suboccipital joints are most likely to be involved when several issues are seen concurrently: asymmetry of motion, facial asymmetry, and sleeping disorders. (28) The procedure to adjust is described as an impulse mechanism. After examination, the clinical findings are compared with the radiographic findings.

"*In most cases the direction of the manipulation is determined by the radiographic findings. In the other cases the orientation of the torticollis, the palpation of segmental dysfunction, or the local pain reaction helps to find the best approach. The manipulation itself consists of a short thrust of the proximal phalanx of the medial edge of the second finger. It is mostly lateral; in some cases the rotational component can be added." (29)*

Biedermann has further elucidated the concepts of MTC in a 2004 text, Manual Therapy in Children. Edited by Heiner Biedermann Churchill Livingstone 2004. The text is extensive and has so much to offer our perspective that a review such as this cannot do it justice. The text has five sections, 'The theoretical base, Clinical insights, The different levels: practical aspects of manual therapy in children, Radiology in manual therapy in children, and Making sense of it all', twenty seven chapters in total. The discussions of embryological development, neurophysiology and clinical insights alone are more than worth the price of the text.

I will include a couple of quotes to whet your appetite.

"…a clear statement of the relation between orthopedic and orthodontic disorders is still missing. Most studies are based on clinical impressions and have anecdotal features. Only a few controlled studies have shown that anatomical features of the craniocervical junction are associated with head posture, mandibular growth and angulation of the cranial base.
In general, there seems to be an association between Angle class II-i.e. distal position of the mandible in the skull – and lordosis, as well as a high incidence of lateral crossbite in patients with scoliosis and torticollis." (31)

"In about two-thirds of cases the effect of the treatment shows in the first 48 hours after the manipulation, but the other third of the successfully treated children need between 2 and 4 weeks to display a change for the better, sometimes only after an initial rebound….it is tempting to try to combine several other modes of treatment to alleviate this phase – for example by using pharmaceuticals.

As far as experience seems to indicate, this approach is ineffective. It seems better to allow enough time for the results of the manual therapy to take effect; they tend to be more profound and stable when the organism is given the chance to re-adjust its functions to the post-manipulation situation without further stimuli." (32)

Biedermann uses his examination of complexity theory to begin to describe two kinds of therapy. He finds humans to be nonlinear systems and while 'robust' therapies *"therapies designed to correct disease entities"* (33) are important at times (such as adjusting to remove a 'pinch' in the shoulder, for example, he finds MTC to be a kind of 'subtle' therapy "*involving therapeutic inputs into the extended network" (34)* that can operate in a broader way throughout the entire network and over an extended time. Examples (besides MTC) included lifestyle issues such as psychological state, diet and exercise. Lack of an objective analysis for KISS and KIDD does however, leave the clinicians in a somewhat nebulous, philosophical zone where art and intuition must make up for the lack of objective rigor.

Overall, we find much that is familiar to us and much that is viewed from a very different perspective. Biedermann allows us in orthogonally based upper cervical work to look at the field from a different perspective. Seeing through another's eyes can be very revealing and productive. Our work has found objective ways to measure the osseous misalignment that we have (completely –at least to our satisfaction)) correlated with postural distortion. Dr. Biedermann and his colleagues do not discern the biomechanical symmetry that we have found (we are aware that there is not absolute symmetry, but symmetry that allows biomechanical stability as noted first by Dr. Gregory) using properly taken radiographs on aligned equipment, using proper patient positioning. As we further develop our communications with Dr. Biedermann, both of our groups may find fertile ground to move forward.

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The Challenge and Potential Impact of Investigating Chronic Low Back Pain by Orthogonal Upper Cervical Chiropractic: A Short History of What Has Been Published

By James Palmer

Introduction

A report in April 2009 indicates that NIHCAM (National Institutes of Health Complimentary and Alternative Medicine) has spent more than $2 billion but may have little influence on mainstream physicians or even CAM providers. [1] Awareness of and willingness to recommend a therapy based on new evidence is of primary importance, especially if a seamless, efficient, cost-effective, affordable, egalitarian health care system is to evolve between CAM and allopathic medicine.

Back pain is the most costly musculoskeletal problem in the United States, the second most common reason for physician visits, and is the third ranked reason for surgery. [2-4] It is widely appreciated that the high prevalence of back pain has serious economic consequences- on the order of a $100 billion a year- as evidenced by the attention from insurers, large corporations, and government research grants.

A Short History: Mainstream

Some literature suggests that physical modalities used by chiropractors may not be effective in the treatment of patients with low back pain. [5] A Systematic review by Assendeflt (2003) found that spinal manipulation therapy (SMT) for chronic low back pain was no more effective than physical therapy or exercise; however, no therapies were found to be superior to SMT.[6] In another systematic review (Bronfort 2004) concluded that SMT for chronic low back pain had better short- and long-term effectiveness than physical therapy and home exercise.[7] A large clinical trial, the UK Beam Trial , which assessed both cost-effectiveness and clinical effectives for SMT, found that SMT improved back function in both short and long term and concluded that SMT is cost effective.[8] Most clinical guidelines have recommended SMT for treatment of low back pain, especially in the acute stage. Haas (2004) conducted a large practice-based comparative study of chiropractic and medical care for LBP and found that the longer the time frame the smaller the advantage of chiropractic care for chronic patients. [9] The literature appears unable to support a consensus or to provide a clear cut choice of an effective therapy-chiropractic SMT or physical therapy.

A Short History: Orthogonal Upper Cervical

Early research on low back pain focused on posture, especially on the aspect that one leg seemed to be shorter than the other. Hilton (1863) indicated a need for “careful measurements” of the short leg because a difference of 6.25mm could cause symptoms. [10] Rush and Steiner (1946) believed that leg length asymmetry of at least 10mm had to be present before back pain is realized in patients. [11] Clarkston reported success on a patient with low back pain after four upper cervical adjustments. [12]

By 1978 Seamann and Gregory used both pelvic distortion and the short leg measurements to conclude that based on a population of 355 patients from four geographic sites that as C-1 Laterality (X-ray) decreases, the pelvic distortion in the frontal plane decreases as measured by use of the Anatometer. This was the true for all 355 cases. [10] Several case studies provide evidence of attenuation of low back pain by adjusting only the atlas. Vaillancourt (1993) provided a case report involving treatment of post -surgical “Low Back Syndrome”, in a patient 19 years after surgical fusion. [13] The patient had a chief complaint of sharp perianal pain (VAS of 7), low back pain, and bilateral posterior thigh pain. A Grostic analysis of X-rays and use of the Life Cervical Instrument for C-1 misalignment resulted in a 40% reduction in atlas laterality and a 33 % reduction in atlas rotation; the second adjustment reported an 80% reduction in atlas laterality. Use of C-1 allowed addressing the problem of not being able to “osseously” adjust the fused segments.

A retrospective study involving managing of chronic low back pain on 45 patients soon followed. Grostic or Sweat upper cervical analysis had been done on the X-rays and instruments were used for adjusting at C-1. Atlas laterality was reduced an average of 61% and atlas rotation was reduced an average of 33%. Twenty two standard orthopedic/neurological tests were selected for the study. Kemp's Test, a major indicator for low back neurological involvement, was initially positive on 44 of the 45 patients; prior to discharge only 7 patients tested positive. Treatment results evaluated by Advancement and Yeoman's tests showed reductions in the range of 50% to 70%. Approximately 40% of the treatment group listed having had head trauma injury. [14] First review of the literature on adjusting only C-1 and its effect on LBP was by Oliverio (1994). [15]

It is understood that soft tissue changes and incorrect proprioception can be detected along the entire spine even though restricted motion, muscle spasm, and pain may be localized [16, 17]. Ito (1999) concluded that leg pain resembling sciatica can be caused by spinal cord compression at the cervical level; sciatica disappeared immediately after decompression surgery. [18] Craniomandibular research suggests linkage between the craniomandibular system, the craniocervical system, and the sacropelvic region. [19]

Mainstream research presenting contrary assessment concludes the three rated "least effective" for treatment of common low back conditions were upper cervical technique, non-thrust reflex/low force, and lower extremity adjusting; however, the article never stated the degree of correction or which "upper cervical technique" was used. [20]

The question is, "What has not yet been tried?" The answer is that there is no clinical trial that has tested the efficacy of using an orthogonal upper cervical technique to reduce C-1 misalignment requiring at least 80% correction on the treatment of subjects with (chronic) low back pain.

The Case for the Central Position of Orthogonal Upper Cervical Chiropractic in Spine Research

It should be evident that present orthogonal upper cervical chiropractic is well-positioned to lead in a "new paradigm" of treating chronic low back pain. A recent study [2006], "Chronic low back pain in individuals with chronic neck pain of traumatic and non-traumatic origin: A population-based study", by Guez et. al. (Acta Orthopaedica, 77:1,132-137) involving more than 4000 subjects summarized the results in the abstract as follows.

"Results: The prevalences of chronic low back pain and chronic neck pain were 16% and 17%, respectively. 51% of subjects had both back and neck pain. Of the patients with neck pain, one quarter had a history of neck injury, which was related to whiplash injury in almost one-half of the cases. The prevalence of chronic low back pain in individuals with chronic non-traumatic neck pain was 53%, and it was 48% in those with chronic neck pain and a history of neck trauma. There was no difference in the prevalence of chronic low back pain between whiplash injury and other types of neck trauma. Confounding factors such as sex, age, marital status, BMI, smoking status and level of education were not significantly different between traumatic and non traumatic groups.

Interpretation : Independently of traumatic or non traumatic origin of the symptoms, the prevalence of chronic low back pain is 3 times higher in individuals with chronic neck pain than in the general population. "

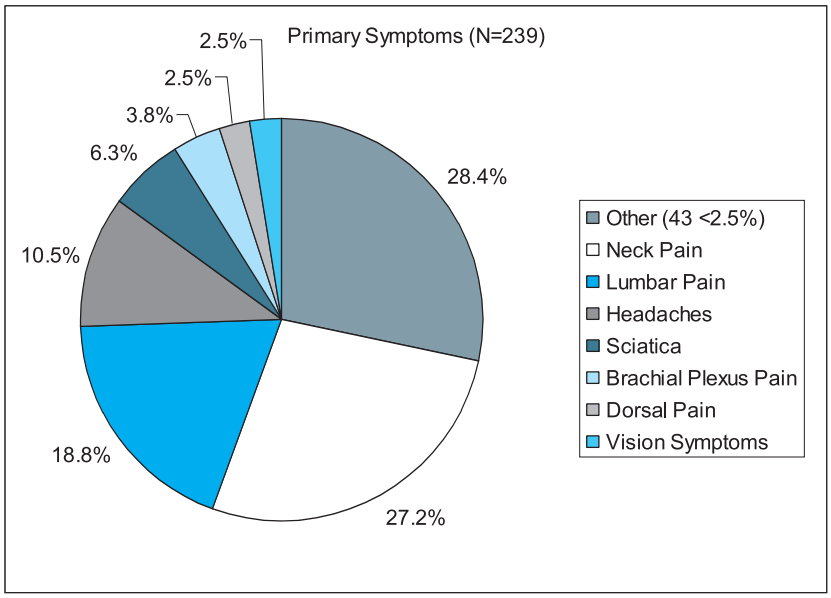
If one can generalize from this study, then practicing orthogonal upper cervical doctors should find approximately 50 percent of new patients that are presenting with chronic neck pain also have chronic low back pain. There is a natural tendency in new patients to seek the care from an upper cervical doctor because of an existing upper quarter problem such as neck pain or headache. In an unpublished study of 239 patients of a single NUCCA doctor 18.5 % had headaches, 38.2% had neck pain, and 30.8% had lumbar pain. {See "Pie-shaped diagrams"} It is reasonable to suspect from such statistics that a sufficient number of subjects have both (chronic) neck ache and (chronic) low back pain. This then supports the opportunity for orthogonal upper cervical chiropractic to concurrently research chronic low back pain and chronic neck pain.

Again the issue is how the problem of research is approached. This author believes that the solution is to approach the problem by using pre and post posture measurements and pre and post X-rays measurements. If a subluxation exists then there must be a biomechanical component. But the neurological-posture relationship usually requires a significant correction to or toward a biomechanical or positional spinal normal thereby leading to or toward a postural normal.

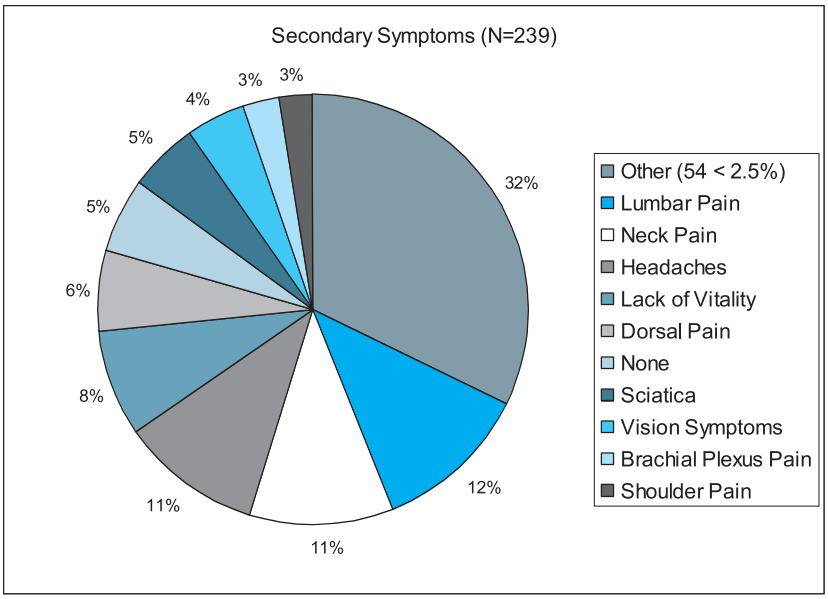
Another study addresses the realization of a continuing problem in chiropractic:

" Like others, we have always found that the available scientific data are not sufficient to make comprehensive assessments of the appropriateness of a medical procedure (chiropractic procedure)" [21] Treatment of chronic low back pain by chiropractors who specialize in correcting the upper cervical spine using a small, controlled- force technique may permit reduction of chronic low back pain without contacting (touching) the site of pain. Patients who have had surgery may find this especially beneficial. Helping people with a history of both neck pain and back pain with the same correction of the top spinal vertebra would potentially lessen the need to see multiple specialists and decrease the cost of care.

Primary Symptoms (N=239)



Secondary Symptoms (N=239)



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