# ORIGINAL RESEARCH

# Evidence-Based Chiropractic Using Functional Assessments in an Upper Cervical Model: A Retrospective Analysis

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## ABSTRACT

**Objective:** This paper describes the use of functional outcome assessments performed pre- and post-adjustment as a key component of evidence-based health care (EBHC) in a chiropractic clinical setting.

**Methods:** A retrospective review of 17 patient records was performed to describe the protocol used in a private chiropractic practice demonstrating the application of functional assessments to support clinical feedback and enroll the patient in shared decision making concerning their course of care. Testing was performed pre-adjustment and positive findings were reevaluated post-adjustment during the same patient encounter. The records were reviewed to assess patient compliance with the recommended management plan.

**Results:** Each positive test indicated a biomechanical and/or neurological deficit in the patient. Reevaluating positive tests after the adjustment showed improved findings. Patient compliance with the care plan appeared to be favorable when involved in shared decision making.

**Conclusions:** This paper discusses one practice model incorporating EBHC practices and protocols that may enroll the patient in shared decision making. The protocol may be easily modified to fit a clinician's individual practice and patient preference.

**Key indexing terms:** *Chiropractic, outcome assessment (health care), evidence-based practice, vertebral subluxation, education*

### Introduction

Evidence-based health care (EBHC) is not a new concept to the health care professions. It was introduced at McMaster's University in the 1980s to develop critical-thinking skills of future medical doctors and incorporate the cutting edge of medical science into a practitioner's decisions regarding patient care.[1] The definition provided by Sackett et al. is "Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients."[2] Fernandez and Delaney discuss that there are several variations in the terminology which include evidence-based health care, evidence-based practice, and evidence-based medicine.[3]

Regardless of the term used, the central idea is a need to incorporate the physician's clinical experience and expertise with the best available published evidence, and the patient's

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preference to determine the method and course of care for each individual patient.[4]

Patient preference involves their personal values, concerns, and expectations of care that, when considered together, determine whether they will accept, reject, or modify the suggested course of care.[5] Thus, patient preference leads us to shared decision making between the doctor and the patient.[4,6] Shared decision making involves the patient from the perspective of what the patient wants, or prefers. Informed patients can better participate in the decisions about their personal health care choices.

Currently, evidence-based practice in chiropractic leans strongly toward Randomized Clinical Trials (RCTs) as the preferred source of the best evidence to answer the clinical question. It appears to be commonly understood that there are limited amounts of RCTs to address the variety of clinical presentations in a chiropractic practice. In the chiropractic profession, there is much discussion about the need to develop facts supporting claims made by the profession.[7,8]

Chiropractic is not alone in having relatively few RCTs supporting individual clinical interventions. A paper written by Lee et al. indicates that general thoracic surgery is not well supported by RCTs.[9] In their paper, the best evidence supporting the surgeries was classified into three categories: 1) evidence from RCTs, 2) convincing non-experimental evidence, and 3) interventions without substantial evidence. The conclusions drawn by Lee et al. indicated that a majority of the evidence supporting general thoracic surgery were from the category of convincing non-experimental evidence.

Neurosurgery is also not well supported by RCTs, and according to Bandopadhayay, et al., RCTs "are not suitable to investigate many neurosurgical problems."[10] Orthopedics appears to have less than 5% of its procedures supported by RCTs.[11]

Sackett et al. explain that there is a need to "follow the trail to the next best external evidence and work from there" for situations where an RCT does not exist.[2] Given the low percentage of RCTs available in peer-reviewed publications of various health care professions to support best evidence practices, it appears that case reports do serve a role as a resource for the clinical practitioner in applying evidence-based health care.[5]

The five steps that have been identified in the practice of EBHC include:[12]

1. Asking a clinical question
2. Searching the literature for the best available evidence to answer the question
3. Appraising the evidence for validity and applicability to the clinical case being presented
4. Using the critical appraisal along with clinical expertise, and the patient's needs and circumstances to apply the integration to the case
5. Evaluating the effectiveness of the clinical decision and explore methods of improvement.

Chiropractic educational institutions have been working to incorporate evidence-based health care practices into their curriculum which should serve to equip future doctors of chiropractic with the critical-thinking skills necessary to incorporate published evidence, along with clinical experience, for a given intervention.[3,13-15]

The purpose of this paper is to illustrate the use of functional assessments performed before and after a chiropractic intervention as a component of practicing evidence-based chiropractic. This approach is suggested as a tool that may facilitate patient understanding, and therefore, aid the patient in making a better informed decision.

**Methods and Results**

Permission to have personal health information published without divulging person identifiers was obtained from the patients prior to the writing of this paper.

This paper describes a clinical setting protocol that uses a pre-adjustment assessment and a post-adjustment functional assessment in the evaluation of an upper cervical subluxation complex. These assessments are performed during the same patient encounter.

A retrospective analysis of the records for 17 patients who presented with chief complaints including headache, migraine headache, low back pain, thoracic pain, hip pain, wellness care, numbness in the upper extremity, leg and foot cramping, shoulder pain, depression, sacroiliac pain, TMJ pain, knee pain, hypertension, and tight neck muscles was reviewed and the protocol summarized.

On the initial visit, in addition to general chiropractic protocol of instrumentation, postural evaluation, scanning palpation and motion palpation, several tests were performed to evaluate for the presence of an upper cervical subluxation complex. These tests included the supine leg check, Median and Ulnar Nerve tests, a modified Trendelenburg test, Romberg test, and a Stork test. Positive tests performed pre-adjustment were reevaluated post-adjustment.

The first test performed was the supine leg check to determine leg length inequality (LLI).[16] The patient lies supine on a firm table with legs hanging approximately 6" off the table. The doctor assessed the patient's functional leg length. The side of the short leg and the amount of leg length inequality were recorded.[17]

A combination of the Median Nerve and Ulnar Nerve tests were used to measure motor function in the C6 and C8 distribution to the hand. This was performed by instructing the patient to tightly grasp together the tips of the thumb and little finger. The doctor grasped the thumb in one hand and the little finger in the other and attempted to separate the tip of the thumb from the little finger. If the patient was unable to keep the thumb and little finger firmly touching, then each finger was isolated and tested. The patient flexed the thumb into the palm and was instructed to try to keep it in place. The doctor attempted to remove the thumb from that location. The same procedure was repeated for the little finger. The weak finger was recorded using a traditional 0-5 muscle grading scale.

The modified Trendelenburg test was performed by the doctor standing behind the patient with a thumb placed on each of the patient's posterior superior iliac spines (PSISs). The patient was instructed to stand on one leg and peddle the opposite leg as if riding a bicycle. The test was repeated on the opposite leg. The side of the PSIS ipsilateral to the raised leg which did not rock inferior was recorded. The modification to the Trendelenburg test was used in this protocol due to the muscular contracture of the pelvis on the functional short leg side producing a rising of the posterior superior iliac crest and the anterior superior iliac crest simultaneously when that leg is lifted to a knee up position.

Romberg test was performed by having the patient stand first with eyes open, and then with eyes closed. If there was no loss of balance with eyes closed, then a provoked Romberg test was performed by the doctor administering a slight nudge to the patient's shoulder. Any loss of balance, or stability, from these maneuvers was noted as a positive finding.

The final test administered was the Stork test. The patient was instructed to keep eyes closed and stand on one leg. The test was then repeated on the other leg. Any loss of balance and the corresponding side of imbalance was noted as a positive finding.

A subluxation complex at C1 was found to be present for all 17 patients based on the combined evidence provided through the history, physical examination, instrumentation, and orthogonal radiographic examination. Upper cervical specific radiographic assessment included the nasium, lateral, and vertex views. These radiographs were analyzed using the Grostic x-ray analysis procedure.[17]

Once the clinical decision that an upper cervical adjustment of C1 was indicated, there was discussion with the patient about the findings, clinical experience based on past experience and published research, and prognosis. The mechanism for delivery of a specific adjustment to C1 was explained to the patient. This approach provided the patient with the information needed to make an informed decision and encouraged shared decision making in the course of care.

A specific upper cervical chiropractic adjustment was delivered using the Grostic technique followed by a post-adjustment assessment using the same criteria, or protocol, used in the pre-adjustment evaluation. This post-adjustment assessment was performed during the same patient visit.

The results of the outcome assessments performed pre- and post-adjustment are illustrated in Table 1. Only the patients with positive findings on a specific assessment would be represented in the number recorded in Table 1. Outcome measures with a negative finding on the pre-adjustment assessment were not performed post-adjustment for that patient.

During the performance of each of these tests, the implication of the findings was discussed with the patient during both the pre-adjustment and post-adjustment phase of care. On the second patient encounter, a report of findings was delivered during which the significance of the functional problems in their initial evaluation was discussed.

A recommended plan of care was discussed with each patient. Of the 17 patients, 15 followed through with the initial care plan. Two of the patients were from out of the country; however, they followed through with the portion of care that was feasible given their travel schedule. Both of these patients returned for a follow-up chiropractic evaluation on their next trip into the country.

**Discussion**

The selection of functional assessments is a key consideration in the practice of EBHC. Functional assessments should not only be reliable and repeatable, but also, be applicable to individual patients.[12] A practitioner's familiarity with published research relative to both the practice model and the clinical case, along with the clinician's expertise should determine which functional assessments to employ.

Dr. John D. Grostic established the dentate ligament theory as a plausible hypothesis for a subluxation complex of C0-C1-C2 and the theory was further supported later by Dr. D. Levine.[18] Dr. Grostic demonstrated how an upper cervical subluxation can affect the lower back and pelvis. The dentate ligament is firmly attached to both atlas and the spinal cord with the attachment specifically to the spinocerebellar tract. The lateral most portion of the dorsal spinocerebellar tract contains the nerves for the lower limbs and lumbopelvic area.

A subluxation at the level of C1 can pull on the spinal cord and disturb the tracts that innervate the low back muscles and pelvis. This lateral portion of the spinocerebellar tract is the site of maximal mechanical irritation, causing a functional short leg.[19] Leg length inequality as measured through the supine leg check has been shown to provide both inter- and intra-examiner reliability.[20,21]

The median nerve arises from the C6-C8 nerve roots and innervates abductor pollicis brevis, flexor pollicis brevis, and opponens pollicis. The ulnar nerve arises from the C8-T1 nerve roots and the deep branch innervates the abductor digiti minimi, flexor digiti minimi, and the opponens digiti minimi.[22]

During the initial portion of the Median Nerve test, both the median and ulnar nerves are being tested. The Ulnar Nerve differential portion comes when each digit is tested individually. The weak digit distinguishes whether there is a problem with the median nerve or the ulnar nerve and, perhaps, compromise to the corresponding nerve roots.

The Trendelenburg test has been shown to be a reliable test for the function of the hip joint.[23] The modified Trendelenburg test demonstrates the motion of the pelvis.[24] During normal motion the PSIS on the ipsilateral side of the raised leg should rock inferior and slightly medial. If the PSIS does not move in this manner it indicates improper pelvic motion, possibly from a fixation in that joint.[25] The results of the modified Trendelenburg test of the 17 patients in this report appear to indicate that there was a change in the movement of the pelvis pre- and post- the upper cervical adjustment.

Romberg's test assesses both the function of the cerebellum and proprioception. If the patient has difficulty maintaining balance with the eyes open, it may be an indication of cerebellar dysfunction. If the patient has difficulty with the test when the eyes are closed, then the problem may be attributed to the dorsal column tract of the spinal cord.[26,27]

The Stork test examines proprioception, the labyrinthine system, and stability of the lower joints in a combined manner.[28,29]

The use of a few, carefully selected tests to illustrate a functional change in a patient can be accomplished without a significant increase in the time required for the patient encounter. Patients may be unaware of functional deficits until they are demonstrated by the clinician during performance of these tests. By utilizing the outcomes of these tests, the clinician may be able to detect and correct problems early in the course of care. Patients may be more likely to follow through with recommended care when they are able to experience improved function resulting from a chiropractic adjustment.

This paper suggests a clinical practice model wherein a selected set of functional assessments are performed during the same patient encounter, both before and after the clinical intervention. Outcome assessments have been largely used in clinical practice at the onset of care, and then subsequently at an interim point, or at the conclusion of care.[5] When functional assessments are used in this fashion, there are many other factors that could enter into influencing the patient's response to care.[5] In this practice model, both the doctor and the patient are able to see functional changes in the pre- and post-adjustment testing without the interference of other factors that may be perceived to influence care.

Little appears to be written about how to learn and apply the skills to incorporate patient preferences in formulating the clinical decision and effectively enrolling the patient in shared decision making. Smith et al. discuss the need for chiropractic students to learn the literature search and appraisal skills early in the curriculum so that they are equipped to apply the evidence in the clinical situation.[13] EBHC education in chiropractic colleges focuses on the literature search and evaluating and critiquing research articles.[30-37] Chiropractic education institutions are attempting to formulate instruction and practical application in the clinical setting.[3]

Orthopedic and neurological tests are well taught in the standard curriculum of chiropractic colleges and appear to be both reliable and repeatable. The authors suggest the inclusion of performing functional assessments prior to, and after the chiropractic adjustment during the same encounter, might enable the practitioner to integrate critical research appraisal with clinical expertise, and encourage patient participation in shared decision making to enhance patient compliance. This approach may also serve to provide enhanced clinical documentation for contributing case reports to the body of literature.

This paper describes a protocol used in one practice model and summarized the findings from the records review of seventeen clinical cases. An assessment of the use of pre- and post-adjustment functional assessments in other clinical practice models would enhance the body of knowledge on the application of EBHC in the clinical setting. A literature review by Fernandez and Delaney indicates that in chiropractic education there are "few studies evaluating EBHC in chiropractic curricula and no studies evaluating patient outcomes after such training."[38]

While advancements are being made in teaching portions of the EBHC model, more research is needed in the clinical documentation of functional outcomes. Further evaluation of patient compliance with a care plan as a result the clinician addressing patient preferences and enrollment of the patient in shared decision making would enhance the body of knowledge about the effectiveness of practicing EBHC.

## Conclusion

This paper discusses the use of functional assessments performed pre- and post-adjustment as part of the process in an evidence-based chiropractic practice. The use of measurable functional assessments may assist the doctor in making the best clinical decision for the patient and provide further documentation to support the doctor's efforts.[39-41] The patient receives immediate feedback about the effects of the treatment, thus providing them with more information as part of the shared decision making process. Improved patient compliance with the care plan may be achieved by addressing patient preferences and encouraging shared decision making.


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Table 1 – Functional assessment results pre- and post-adjustment of C1

| Assessment Tool | Pre-adjustment Positive Findings | | Post-adjustment Negative Findings |
|---|---|---|---|
| | Left | Right | |
| Supine leg check* | 12 | 5 | balanced (n = 17) |
| Median/Ulnar nerve tests | 9 | 4 | complete resolution (5/5) (n = 9)<br>significant improvement (n = 4) |
| Modified Trendelenburg | 10** | 8** | complete resolution (n = 16)<br>improved function (n = 1) |
| Romberg (provoked) | 1 | 1 | complete resolution (n = 1)<br>significant improvement (n = 1) |
| Stork | 5** | 2** | complete resolution (n = 4)<br>significant improvement (n = 2) |

* ¼” or greater functional leg length discrepancy noted on the side indicated

** One bilaterally positive finding is represented in both the left and right column