

COMPARISON OF OTHER PALPATION TECHNIQUES OF THE THORACIC SPINE TO THE MOTION PALPATION TECHNIQUE: A PILOT STUDY

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ABSTRACT

Objective: To validate and compare leg-length assessment, visual assessment, qi energy palpation and palpation of tender points to the motion palpation technique of the thoracic spine to determine the level of chiropractic subluxation. This information is important to give guidance to chiropractors and other manual therapy providers on which diagnostic palpation techniques should be used in practice. Determining which assessment procedures have the best intraexaminer and interexaminer reliability is important for improving clinical outcomes and ensuring that evidence-based chiropractic diagnostic techniques become more widely practiced.

Methods: Anonymous and voluntary pilot study with student participants recruited from our university. A total of 50 participants between the ages of 20 and 40 years old took part in this study. There were 29 men and 21 women. The following 5 palpation methods were used on the participants' thoracic spines assessing for the level of subluxation from the T1 through T12 vertebral levels: motion palpation, Qi energy palpation, visual inspection, leg-length evaluation using the Activator Methods Chiropractic Technique (AMCT), and tenderness palpation. All participants were assessed in the prone position. All examiners were blinded to the findings from the other examiners and to the identity of the participants. Cohen's Kappa (κ) test was used to determine the level of agreement between examiners for our study. The Landis scale for interpreting kappa was used to display the findings.

Results: A total of 50 students participated in the study. The total number of subluxations found at each level of the thoracic spine by the 5 examiners was determined. There was little agreement between the examiners. For the entire thoracic spine, the level of agreement between the motion palpation technique and the other techniques

ranged from none to slight. At the individual vertebrae level, agreement was similar with the exceptions of visual inspection at T1 ($\kappa = 0.357$) and leg-length assessment at T12 ($\kappa = 0.345$).

Conclusion: Practitioners who use manipulation of the spine need a valid and reliable method to detect subluxations of the vertebra. This study did not find acceptable levels of agreement between 4 different methods of palpation compared with motion palpation for detecting subluxations in the thoracic spine. Further research should be conducted using symptomatic patients to determine if any of these palpation methods can be reliable and valid. (*J Contemporary Chiropr* 2022;5:136-144)

Key Indexing Terms: Chiropractic; Motion Palpation; Thoracic Spine;

INTRODUCTION

The diagnosis of joint dysfunction plays a major role in the chiropractic approach to patient management. A reliable biomechanical diagnosis is necessary to justify and direct the use of manipulation. Chiropractors and other manual therapy practitioners use manipulation of the spine to normalize function, decrease pain, and allow patients to return to normal activities. (1)

Palpation of musculoskeletal tissues forms an important part of physical examination in chiropractic care. Different methods have been used by practitioners of manual therapy to determine where and how the spine should be manipulated, including motion and static palpation, leg length assessment, palpation for tenderness, visual inspection, and radiological analysis. (2,3) The reliability of these methods has been found to range from none to moderate in various studies. (1,4-7)

Motion palpation is 1 of the most common diagnostic methods used by chiropractors, although its clinical usefulness has not been adequately established in the literature. (8) This technique has the advantages of not requiring radiation exposure nor specialized

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equipment. According to a survey conducted by Walker *et al.*, motion palpation is considered the most reliable diagnostic method often used by chiropractors. (9) Moreover, Fritz *et al.* examined the predictive validity of posterior-anterior (PA) mobility testing in a group of patients with low back pain and concluded that patients with LBP and hypomobility experienced greater benefit from an intervention including manipulation than from stabilization. (10)

Fryer reviewed various studies showing the reliability of palpation for spinal muscle tenderness. This review found that palpation for paraspinal tenderness was more reliable than palpation for tissue texture. (11) According to Boline, palpation of lumbar paraspinal and spinous process tenderness are considered to be the most reliable methods for determining where to manipulate, showing good to excellent interexaminer agreement ($k = .48-.90$ and $k = .40-.79$, respectively). (12) Hubka and Phe-Lan reported that palpation of cervical spine tenderness was also highly reliable ($k = .68$). (13) Nilson *et al* found similar results in their study of the reliability of palpation for cervical erector spinae muscle tenderness. (14) Christensen *et al.* observed similar results for the reliability of thoracic paraspinal tenderness, and considered examiners to agree when their findings were ± 1 spinal segment level (15); as did Harlick in a study of the accuracy of static spinal palpation. (16)

Visual inspection is a common component of the physical examination and spinal assessment of chiropractic patients. According to a survey of Canadian chiropractors, visual assessment of posture was routinely performed by over three-quarters of respondents. (17) Similarly, a survey of Belgian chiropractors found visual postural analysis was performed on 72% of all new patients. (18) Walker *et al.* surveyed Australian chiropractors and found that visual postural analysis was among the most commonly used diagnostic methods for detecting areas requiring manipulation. (9) Despite this, only a few studies have looked at the intraexaminer and interexaminer reliability of visual inspection and postural assessment and the results were mixed. (1)

Leg length assessment is a commonly used chiropractic technique, employing multiple methods including the Derifield Pelvic Leg Check (DPLC) and the leg length evaluation using the Activator Methods Chiropractic Technique (AMCT). Hinton found that 39% of Canadian chiropractors surveyed indicated that they always documented leg length differences on their patient's initial visit. (17) He found that chiropractors employed leg length assessment just as frequently on subsequent visits. Mansholt surveyed chiropractor employees and students at a Chiropractic college and found that between 38-55% of 9th-term chiropractic students reported that prone leg-length assessment techniques should be

performed on all routine patient encounters compared to 27% of chiropractor employees. (19) Evidence is still inconclusive on the interexaminer and intraexaminer reliability of leg length assessment techniques, but some studies show promising results. (5,20-23)

Energy healing techniques have been used by various cultures for thousands of years. Many cultures have a concept of vital energy (including the Indian term prana, the Chinese term chi, and the Japanese term qi). This vital energy is described as a subtle, non-physical energy that has a specific effect on the mind and body. Pain in the muscles, tendons and joints is often associated with stagnation in the movement of this vital energy in the body. Therefore, treatment techniques that facilitate movement and regulate vital energy are often beneficial in relieving pain. (24) Schwartz tested whether health care providers (including physicians, nurses and psychologists) could detect bioenergy before and after bioenergy awareness training. The study concluded that training can improve bioenergy awareness after five days of intensive training. (25) Nelson studied the claim that energy healers can sense the biofields of their patients with their hands. Biofields are bioenergy which surround and extend beyond one's body. He found that humans have the capacity to detect biofields, but the capacity varies widely between individuals with some unable to detect above chance and others having substantial biofield awareness. (26)

Triano reviewed methods used by chiropractors to determine the site for applying manipulation and found the most convincing favorable evidence was for methods which confirmed or provoked pain at a specific spinal segmental level or region. There was also high quality evidence supporting the use, with limitations, of static and motion palpation, and measures of leg-length inequality. (27)

No research was found in the literature on the level of agreement between motion palpation and various other methods of determining where to manipulate the spine. The purpose of this study was to validate and compare leg length assessment, visual assessment, qi energy palpation and palpation of tender points to the motion palpation technique of the thoracic spine to determine the level of subluxation. To our knowledge, there are no published studies on visual assessment of a patient in the prone position to determine the level of subluxation, nor any studies on qi energy palpation to find the level of subluxation. This information is important to give guidance to chiropractors and other manual therapy providers on what diagnostic palpation techniques should be used in practice. Determining which assessment procedures have the best intraexaminer and interexaminer reliability is important for improving clinical outcomes and ensuring that evidence-based



Figure 1. Participant Positioning

chiropractic diagnostic techniques become more widely practiced.

METHOD

We conducted an anonymous and voluntary pilot study approved by our university's Institutional Review Board (IRB) with student participants recruited from our university. A total of 50 participants between the ages of 20 to 40 took part. There were 29 men and 21 women. Participants were excluded if they had recent injury to the thoracic spine or previous surgery of the thoracic spine. Completing the informed consent indicated their willingness to participate in the study.

Participants were scheduled 10 at a time. All participants put on a gown, took off their shoes and socks, and were instructed to lay prone, with their arms at their sides, on 10 adjacent tables. Each table was 19" tall. One teaching assistant was a note taker and did not participate in any palpation procedures. Another faculty member was the organizer and marked the individual thoracic spinous processes from T1 to T12 with a skin marking pencil as seen in Figure 1. The organizer did not participate in any palpation procedures. The examiners came into the room one at a time and then assessed the participants consecutively. The note taker entered their findings on a recording form. Once the examiner had finished

palpating all participants, the examiner would leave the room and not talk to the other examiners. The next examiner would then enter the room and perform their palpation procedures. This procedure was repeated each day until all 5 examiners had completed their palpation on 10 participants for that day. This process was repeated for a total of 5 days. The examiners were assigned to conduct their tests in a random order each day. All examiners were blinded to the findings from the other examiners and to the identity of the participants.

The following palpation methods were used:

- **Motion Palpation:** The examiner stood at the side of the table and made a hypothenar contact on the T12 spinous process to assess posterior to anterior (P-A) glide of that segment. The examiner continued assessing P-A glide of each thoracic spinal segment up through T1. The segments with restricted P-A glide were recorded as a subluxation.
- **Qi (Energy Palpation):** The examiner stood on the side of the table and placed the palm of one hand over T1, as close to the skin as possible without touching it. The examiner then moved the hand inferiorly toward T12 in a slow and deliberate manner, feeling for changes in Qi, or energy, from 1 segment to the next (felt as an electrical tingling in the palm). Spinal levels of increased energy, also called Qi stagnation in Eastern Medicine, were reported as a subluxation.
- **Visual Inspection:** The examiner started at the top of the table looking straight down the spine midline from T1 to T12 observing for any alterations in smoothness of the kyphotic curve which may indicate an area where a segment has moved posteriorly in relation to the surrounding vertebrae. This process was repeated by looking at the patient from the side. The examiner then scanned the thoracic spine for any color changes including redness or paleness in relation to the surrounding tissues. The paraspinal musculature was also observed for asymmetry. The areas with the above-mentioned aberrations were reported as a subluxation.
- **Leg Length Evaluation:** An Activator Methods Chiropractic Technique (AMCT) Proficiency Rated examiner assessed leg length inequality in position 1 (knees extended) and pressure tested at each thoracic vertebral level to determine the level of subluxation in the thoracic spine. (28) The examiner repeated this procedure for each level of the thoracic spine.
- **Tenderness Palpation:** The examiner stood at the side of the table and made a digital contact on the T12 spinous process to assess for tenderness. The examiner continued assessing tenderness of each thoracic spinous process up through T1. The examiner

asked each participant to tell them where they felt tenderness. The examiner attempted to push with the same force on each participant. The segments with tenderness were recorded as a subluxation.

Cohen's kappa, symbolized by the lower-case Greek letter (κ) is a robust statistic useful for either interrater or intrarater reliability testing. Similar to correlation coefficients, it can range from -1 to +1, where 0 represents the amount of agreement that can be expected from random chance, and 1 represents perfect agreement between the raters (29). The Kappa test was used to determine the level of agreement between examiners for our study. The Landis scale (30) for interpreting kappa was used for this study (Table 1).

Table 1. Landis Scale

0.01-0.20	Slight agreement
0.21-0.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-0.80	Substantial agreement
0.81-1.00	Almost perfect agreement.

Analysis was performed for each level separately and for all thoracic vertebral levels combined.

RESULTS

A total of 50 students participated in the study. The total number of subluxations found at each level of the thoracic spine by the 5 examiners are shown in Table 2. There was little agreement between the examiners.

For the entire thoracic spine, the level of agreement between the motion palpation technique and the other techniques ranged from none to slight (Table 3). At the individual vertebrae level, agreement was similar with the exceptions of visual inspection at T1 (0.357) and leg length assessment at T12 (0.345).

DISCUSSION

Although motion palpation is taught in chiropractic education, and is considered by many practitioners to be the gold standard for detecting spinal subluxations, previous research has shown that it has only slight to moderate agreement when used by different doctors (interexaminer reliability). (4-7,31) This pilot study was performed to determine the level of agreement between doctors using motion palpation, palpation for tenderness, leg length check, Qi energy palpation, and visual inspection methods for the thoracic spine. The interexaminer reliability ranged from none to slight,

Table 2. Subluxations found at each vertebral level (out of 50 participants)

	Qi (Energy Palpation)	Visual Inspection	Leg Length Assessment	Spinous Process Tenderness	Motion Palpation
T1	11	10	22	4	16
T2	22	14	16	4	21
T3	14	18	5	11	30
T4	6	14	23	22	31
T5	4	4	4	18	26
T6	26	17	36	13	17
T7	7	13	2	12	12
T8	4	13	25	18	18
T9	6	5	5	13	14
T10	19	9	8	12	10
T11	11	3	4	7	8
T12	3	7	17	7	3

with kappa values that ranged from -0.005 to 0.150. McHugh determined that any kappa below 0.60 indicates inadequate agreement among the raters and little confidence should be placed in the study results. (29) The lack of agreement found in this study between any of the methods and motion palpation puts into question the validity of these methods.

Clinicians who use manual manipulation techniques should not rely on palpation alone to determine where adjustments should be performed. Feeley found a high level of interexaminer reliability with assessing Achilles heel tension resulting from adverse mechanical spinal cord tension. (32) In 1 review of the methods used by chiropractors, it was found that skin rolling and palpatory assessment of tissue texture, range of motion, and current perception threshold (CPT) are higher quality indicators of nervous system deficits and should be considered as methods to couple with palpation techniques in determining vertebral levels to adjust. (27)

Many studies have been conducted to evaluate the reliability of motion palpation of the spine. A study by Lakhani *et al.* showed that motion palpation of end-feel assessment appears to be a responsive post-manipulation assessment tool in the cervical spine for determining whether perceived motion restriction found before treatment improves after spinal manipulative therapy (SMT). (33) Cooperstein *et al.* found interexaminer reliability of thoracic motion palpation to be "good" between 2 examiners assessing posterior to anterior glide of T3-T10 in the prone position on 52 volunteers. (34)

Table 3. Kappa for agreement of motion palpation to other methods

Level	Qi (Energy Palpation)	Visual Inspection	Leg Length Assessment	Spinous Process Tenderness
Total	-0.005	0.150	0.067	-0.035
T1	0.096	0.357	-0.133	0.148
T2	-0.098	-0.003	0.021	0.062
T3	-0.277	-0.049	0.098	-0.176
T4	0.159	0.016	-0.144	0.087
T5	-0.087	-0.087	-0.046	-0.161
T6	0.013	0.104	0.019	-0.066
T7	-0.1	-0.066	0.169	-0.087
T8	-0.005	0	0.059	0.059
T9	0.082	0.082	-0.071	-0.202
T10	-0.134	0.187	0.04	0.112
T11	-0.104	0.018	0.196	0.16
T12	0.127	-0.002	0.345	-0.064

An annotated bibliography of spinal motion palpation reliability studies by Haneline revealed 8 studies with a high level of reliability, and 2 of them were rated as high quality. Most of these studies used percent agreement or intraclass correlation coefficient (ICC) statistics, instead of a more accepted statistical method such as Kappa (κ). (31) The use of percent agreement alone in reliability studies may overestimate the true amount of agreement as it does not correct for agreement observed due to chance. (35)

Hestøek and Leboeuf-Yde found that motion palpation specific to detecting decreased motion, or lack of end-play has validity specifically in the lumbar spine region. (1) With low back pain being the most prevalent musculoskeletal condition and the leading cause of years lived with disability globally (36), conducting research on patients with active low back pain is necessary to future research. Seffinger found that pain provocation tests are most reliable when compared with other palpation methods. (37) The inclusion of patients with active low back pain would allow for a comparison of pain palpation with motion palpation, hopefully increasing the interexaminer reliability of future studies.

Qi energy palpation is a widely used diagnostic method in Eastern Medicine and has been measured in various studies as heat, protons, and electromagnetic shifts within fascia. (38) Qi has been defined as “the flow of signal transduction mechanisms that occurs in cells.” (39) Qi palpation is similar to the term “tonal palpation” used in such chiropractic techniques as Network Spinal

Chiropractic (40), Torque Release Technique (41), and others. In an attempt to better define the energy palpated and released through the spine, research conducted on the Network Spinal Wave at the USC Department of Engineering found that measurable sound energy, called a soliton, is released through the spine. (42) These studies and definitions indicate that palpation of qi energy could be applied to finding changes in the dynamic function of a vertebral joint complex. One issue with the use of this palpation method is that areas where qi or energy is increased may be found to be adjacent to the area of subluxation. In other words, the adverse spinal cord tension may cause a “bunching up” of energy above or below the area of subluxation. Despite the wide use of qi energy palpation in Eastern Medicine and the use of “tonal” palpation in “tonal chiropractic” techniques, studies on the diagnostic reliability of qi energy or tonal palpation were not found in prior literature and should be researched further.

Hestøek and Leboeuf-Yde reviewed 3 studies examining the interexaminer reliability of visual inspection. One of the 3 studies also reviewed intraexaminer reliability. The results of these studies showed poor intraexaminer and interexaminer reliability during seated examination of iliac crest height ($\kappa = -0.008$ and $\kappa = 0.239$ respectively) and PSIS height ($\kappa = 0.248$ and $\kappa = 0.150$ respectively); marginal interexaminer reliability with prone examination of gross asymmetry, local hyperemia, edema and skin lesions ($\kappa = -0.06-1$); and fair to excellent interexaminer reliability for inspection of muscle asymmetries and skin lesions ($\kappa = 0.34-0.84$). (1) According to Walker, visual postural analysis is performed by chiropractors looking for body structure and spinal asymmetries and often focuses on the positions of the pelvis, spine, shoulders, and head. According to the study, the purpose of visual postural analysis was to ascertain visual clues of underlying spinal abnormalities including kyphosis, lordosis, scoliosis, antalgia, spondylolisthesis and leg-length differences. Chiropractors often use these clues when determining the location of spinal subluxations, despite a lack of scientific evidence showing a direct connection. (43)

There are several publications looking at the interexaminer reliability of a standardized leg check procedure (in the prone and the supine positions) used to screen for leg-length inequality and to determine the level of subluxation or joint dysfunction. Woodfield *et al.* demonstrated moderate reliability in assessing leg-length inequality at 1/8 inch increments and good reliability in determining the presence of a leg-length inequality. (20) One study by Holt *et al.* evaluated the interexaminer reliability of a leg-length analysis protocol between an experienced chiropractor and an inexperienced chiropractic student. They found good interexaminer reliability of all aspects of the leg-length analysis in the prone straight leg and flexed knee positions used in the

study. The investigators also used the kappa (κ) analysis, similar to our study, and found kappa scores ranged from 0.61, with 72% agreement, for the combined positions to 0.70, with 87% agreement, for the extended knee position. (5) Additional studies have indicated that 2 clinicians show good interexaminer reliability in determining the side of the short leg in the prone position with knees extended (21), and good interexaminer reliability between 2 doctors in a private chiropractic office with 52 patients by using the Activator Methods Chiropractic Technique (AMCT) to detect leg-length inequality in the prone extended knee position. (22) Wallace determined that interexaminer reliability of leg-length discrepancy averaged 82.2% among students trained in using the Activator Methods Chiropractic Technique (AMCT). Wallace concluded "The results of this classroom study are encouraging and suggest that with further controlled studies, uniformity in leg-length analysis could be reached within the chiropractic profession." (23)

Within a cohort of Danish children and adolescents, thoracic spine pain (TSP) was the most commonly reported site of spinal pain and 38% of the cohort reported some kind of impact from spinal pain, such as reduced physical activity and care-seeking. (44) Similarly, in a cohort of adults reporting TSP, 23.5% reported difficulty with activities of daily living due to pain (compared to 30.3% and 41.1% for neck and low back pain respectively). (45) Additionally, thoracic spine pain has been identified as a significant predictor of failure of returning to work in good health among individuals who present with back pain in primary care facilities. (46) Collectively, these data suggest that TSP imparts an economic and social impact comparable to neck and low back pain. (47)

Niemeläinen *et al.* reported that 17% of males reported thoracic spine pain. One-quarter of the males experiencing TSP had difficulties in daily activities. Female sex and younger age (children and adolescents) are also risk factors for thoracic spine pain. (20) Patients with thoracic spine pain often undergo clinical evaluation to assess the need for therapy and measure its results. (48) Thus, it is necessary to study the reliability of the clinical methods for thoracic spine evaluation. (49)

A recent systematic review by Nim *et al.* explored the importance of selecting the correct site, or spinal level, to apply spinal manipulation when treating spinal pain and determined that the current evidence does not support that spinal manipulative therapy (SMT) applied at a supposedly "clinically relevant" candidate site (specific vertebral level) is superior to SMT applied at a supposedly "not clinically relevant" site for individuals with spinal pain. (50) A major hindrance to finding the exact site to treat is the poor diagnostic performance of many clinical tests, including segmental motion testing, used to locate aberrant spinal function. (27,51)

Beynon *et al.*, found that static palpation was overall moderately reliable for the identification of segmental thoracic spine stiffness and tenderness, with tenderness demonstrating a higher reliability with a study group of 36 participants. The study also revealed increased agreement among the doctors within the mid-thoracic spine. (52)

A systematic review by Briggs *et al.* found that the lifetime prevalence of thoracic spine pain has been found to be 15.6%-19.5%. (47) We agree with the observation by Briggs *et al.*, "Unlike neck and low back pain, the burden of thoracic spine pain (TSP) has not been well established, which represents an important avenue for future research." (47)

French *et al.* noted that 1 of the reasons for clinical disagreement between practitioners examining the low back, is that patients are examined multiple times in one day. They note that this may lead to changes in the function of the spine and may affect a variation in the presence of manipulable lesions in the spine. However, this possibility needs further scientific study to confirm its plausibility and the role it may play in affecting outcomes. (2)

Limitations

One limitation is that students from a chiropractic technique class were the only participants. These students tend to be younger and healthier than typical patients in a chiropractic practice. No attempt was made to determine if these students had any symptoms in the thoracic spine. Thus, these findings may not be generalizable to the populations that seek care from chiropractors. Another possible limitation is that the order of the palpation procedures was randomized in this study. Since some of the procedures, such as the motion palpation, move the vertebrae, this could impact the findings of less invasive procedures like the visual inspection and the qi energy palpation.

CONCLUSION

Practitioners who use manipulation of the spine need a valid and reliable method to detect subluxations of the vertebra. This study did not find acceptable levels of agreement between 4 different methods of palpation compared with motion palpation for detecting subluxations in the thoracic spine. Further research should be conducted using symptomatic patients to determine if any of these palpation methods can be reliable and valid. Examples of future studies may include co-diagnostic methods statistically shown to have higher reliability, such as assessing Achilles' heel tension, the use of skin rolling and palpatory assessment of tissue texture, range of motion, and current perception threshold (CPT). These methods should be assessed in populations of patients

with active thoracic or low back pain in conjunction with the palpation methods used here to further assess the reliability of individual palpation methods.

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