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The therapeutic efficacy of thoracic spine manipulation when combined with common conservative interventions for patients with mechanical neck pain

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The therapeutic efficacy of thoracic spine manipulation when combined with common conservative interventions for patients with mechanical neck pain

Disciplines

Physical Therapy

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Title: The therapeutic efficacy of thoracic spine manipulation when combined with common conservative interventions for patients with mechanical neck pain

Introduction: For the purpose of my clinical question, I want to know what the research indicates for the clinical utility of thoracic manipulation as an intervention to reduce cervical spine pain in a population commonly seen by outpatient physical therapists (PT). Effectiveness of cervical manipulation for this specific population is well documented in the literature. Although proven to be efficacious, this technique comes with the inherent risk of vertebral artery compromise, potentially resulting in a cerebrovascular accident (CVA). Due to the possibility of a life-threatening consequence resulting from this specific intervention, PT's are beginning to reduce these risks by focusing on the thoracic spine with the same goal of reducing mechanical neck pain. I am interested specifically in the grade V thoracic manipulation, based on the clinical experience of several orthopedic manual therapists. These clinicians claim that clients experience a "greater pain reduction response" to grade V manipulations compared to non-thrust grade IV mobilizations. Objective findings noted by the clinicians include improvements in rotation restrictions at the cervical-thoracic junction that are more profound with a grade V manipulation.

Clinical Scenario: I was lead to pursue this question by a 43-year-old female who presents with insidious onset cervical spine pain described as a deep dull ache that has gotten progressively worse during recent months. Aggravating factors include typing on her computer and looking down to read. Objective findings include general lower cervical hypomobility on the right during ipsilateral extension/rotation quadrant testing. Significant forward head posture was also noted with concomitant thoracic kyphosis and bilateral shoulder protraction. During treatment, the PT chose to perform thoracic manipulation in an attempt the increase segmental mobility at the thoracic level, inducing a more normalized extension pattern along with the theoretical neurophysiologic elements of pain reduction post-facet cavitation caused by the manipulation. This intervention was followed by home exercise program (HEP) instruction and postural education.

Clinical Question: Is the addition of thoracic manipulation to the treatment plan effective for reducing neck pain greater than a plan of care that excludes the technique?

Clinical PICO:

- P:** Adults 30-50 years of age in an outpatient setting with a chief complaint of neck pain
- I:** Thoracic manipulation and standard rehabilitation (postural reeducation, ergonomics, strengthening, modalities)
- C:** Standard rehabilitation (postural reeducation, ergonomics, strengthening, modalities)
- O:** Pain and disability

Overall Clinical Bottom Line: Based on the results of the two studies by Gonzalez et al. and Cheung et al., there is strong evidence to suggest that for adults diagnosed with chronic or acute mechanical neck pain (less than one month to greater than three months), implementing an intervention protocol that incorporates grade V thoracic manipulation (3-16 manipulations over 3-4 weeks), would result in greater improvements in pain and disability when compared to a protocol that excludes manipulation. Using validated and reliable outcome measures, both articles demonstrated clinically significant improvements in pain and disability for the groups that received thoracic manipulations. There were no adverse effects reported in either study and the cost of receiving the manipulation was only the estimated time of 2-3 minutes to administer.

Search Terms: Neck pain, thoracic manipulation, visual analog scale, physical therapy, efficacy

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Rational for chosen articles: To ascertain the literature relevant to my clinical question, I initially located seven articles using mainly online databases which consisted of CINAHL, PEDro and PubMed. I narrowed the selection down to my three chosen articles due to high similarity to my clinical question, appropriate population, recent publication dates and PEDro scores ≥ 8 . The three articles are listed below. Table 1 shows the PEDro scores. All 3 articles were scored by the PEDro database.

Article 1:

Gonzalez-Iglesias, J et al. Inclusion of thoracic spine thrust manipulation into an electro-therapy/thermal program for the management of patients with acute mechanical neck pain: A randomized clinical trial. *Manual Therapy*. 2009; 14:306-313.

PEDro Score: 9/10

P: Patients 23-44 years of age with acute mechanical neck pain

I: Thoracic manipulation, electrotherapy, superficial heat, soft tissue massage

C: Electrotherapy, superficial heat, soft tissue massage

O: Numerical pain rating scale (NPRS), Northwick Park Neck Pain Questionnaire (NPQ), cervical range of motion

Article 2:

Mun Cheung Lau, H et al. The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain: A randomized controlled trial. *Manual Therapy*. 2011;16:141-147.

PEDro Score: 8/10

P: Patients 18-55 years of age with chronic mechanical neck pain

I: Thoracic manipulation, infrared radiation (IRR), educational material (pathological explanation, exercise, and mobility training)

C: IRR, educational material (pathological explanation, exercise, and mobility training)

O: Numerical pain rate scale (NPRS), Northwick Park Neck Pain Questionnaire (NPQ), cervical range of motion, Cranial-vertebral angle

Article 3:

Cleland A, J et al. Immediate effects of thoracic manipulation in patients with neck pain: A randomized clinical trial. *Manual Therapy*; 10: 127-135.

PEDro Score: 8/10

P: Patients 18-60 years of age with mechanical neck pain

I: Thoracic manipulation

C: Placebo thoracic manipulation

O: Pain visual analog scale, Neck disability index

Table 1: Comparison of PEDro Scores

	Gonzalez-Iglesias <i>et al.</i>	Mun Cheung Lau <i>et al.</i>	Cleland <i>et al.</i>
Random Allocation	Yes	Yes	Yes
Concealed Allocation	Yes	Yes	Yes
Baseline Comparability	Yes	Yes	Yes
Blind Subjects	Yes	No	Yes
Blind Assessors	Yes	Yes	Yes
Blind Therapist	No	No	No
Intention- to-Treat Analysis	Yes	Yes	No
Between Group Comparison	Yes	Yes	Yes
Adequate Follow Up	Yes	Yes	Yes

Point Estimates and Variability	Yes	Yes	Yes
Total Score	9/10	8/10	8/10

Based on the above PEDro score comparison and their respective PICO's, I have chosen to write this critically appraised paper on the articles by Gonzalez-Iglesias et al. and Mun Cheung Lau et al. I decided to exclude the article by Cleland et al. secondary to their utilization of a placebo thoracic manipulation as the only therapeutic intervention received by the control group. This approach does not correlate with my current clinical question which involves standard rehabilitation techniques to alleviate mechanical neck pain. The article does not specify if the placebo thoracic manipulation was modified in a fashion to still allow for a grade IV mobilization during the pre-manipulation hold at the joint barrier.

Article: Gonzalez-Iglesias, J et al. Inclusion of thoracic spine thrust manipulation into an electro-therapy/thermal program for the management of patients with acute mechanical neck pain: A randomized clinical trial. *Manual Therapy*. 2009; 14: 306-313

Clinical Bottom Line: Based on the results of this randomized clinical study with 45 adults, there is strong evidence to support that for patients with acute mechanical neck pain, an intervention involving a total of 3 thoracic manipulations combined with electro/thermal modalities and soft tissue massage, resulted in significantly greater improvements in pain and disability when compared to an identical protocol that excluded manipulation. Assessed at baseline and during the one-week follow-up, the two reliable and valid outcome measures of interest were the Numerical Pain Rating Scale, and the Northwick Park Neck Pain Questionnaire. There was a statistically significant difference between groups at the 1-week follow-up on both outcome measures, favoring the addition of thoracic manipulation. At the 1-week follow-up, only the manipulation group met the MCID for the NPRS (2 points) and the NPQ (25% reduction), proving the technique clinically effective for decreasing pain and disability. The internal validity of this study was good (PEDro score 9/10) with two possible threats, one moderate and one minor. Based on this one study, the benefit of receiving thoracic manipulation outweighs the costs (*i.e.*, entry-level physical therapist training and approximately 10 minutes of treatment time). Additional research should incorporate a longer follow-up in order to assess the long-term efficacy of thoracic manipulation for decreasing pain and disability. Additional research should also include other common interventions for treating acute neck pain (*e.g.*, therapeutic exercise/activity, postural re-education, other forms of manual therapy). This option would allow for a more significant understanding regarding the true power of thoracic manipulation in an outpatient physical therapy clinic.

Article PICO:

Population: Patients 23-44 years of age with acute mechanical neck pain

Intervention: Thoracic manipulation, electro-therapy, superficial heat, soft tissue massage (n=23)

Comparison: Electro-therapy, superficial heat, soft tissue massage (n=22)

Outcome: Numerical Pain Rating Scale (NPRS), Northwick Park Pain Questionnaire (NPQ), cervical range of motion

Blinding: The authors utilized an approach that incorporated blinding of the patients to their treatment group allocation along with the respected interventions they would be receiving. Blinding of the single assessor post-intervention was also incorporated, but the blinding of PT's responsible for the application of the therapeutic interventions was not overtly stated. Following the study, the subjects were tasked with a post-experiment questionnaire to analyze the adequacy of the blinding; results were not specified.

Controls: The non-manipulation group that received standard rehabilitation consisting of superficial thermal therapy, transcutaneous electrical nerve stimulation (TENS) and soft tissue massage was the intervention protocol designated as the control. The absence of a placebo group does not diminish the adequacy of the authors' selected control group because the only

difference between the two groups was the inclusion of the grade V manipulation (*i.e.*, the independent variable). Unlike the standard treatment protocol mentioned above, an intentional placebo intervention is not an accepted form of treatment, nor is it necessary for determining the clinical effectiveness of an intervention. Utilizing an accepted protocol helps PT's to establish a foundation based on real time clinical practice supported by empirical evidence.

Randomization: The authors utilized a convenience sample from referring primary care physicians seeking physical therapy for their patients. A total of 45 subjects were randomly allocated into the two treatment groups by a computer generated randomizing program. Individual group assignment cards were stored in opaque envelopes prior to dispersal, evidencing concealment. Baseline measurements for age, gender, pain, disability, cervical range of motion and duration of symptoms were all statistically similar between the groups, indicating a successful randomization.

Study: 45 subjects with acute mechanical neck pain participated in this randomized controlled trial. Individual patients were referred to an outpatient physical therapy clinic by their physician. Inclusion criteria were adults between the ages of 18 and 45 years, with primary symptoms with a duration of less than one month including neck pain with shoulder girdle referral that had the potential for provocation during movement testing and tissue palpation. Prospective subjects were excluded if they possessed any pathology that would deem manipulation contraindicated. Other exclusion criteria included past medical history of whiplash-associated disorders, surgical intervention for the cervical spine, upper or lower motor neuron pathology at the cervical level, fibromyalgia, osteoporosis, systemic infection, past treatment history of spinal manipulation within two months. The experimental group (manipulation group; n=23) received thoracic spine manipulation, superficial heat from an infrared lamp, TENS, and soft tissue massage. The control group (n=22) received the identical protocol as the experimental group with the exclusion of thoracic spine manipulation. The two groups received their intervention protocols during six sessions of therapy over three consecutive weeks. The application of modality therapy occurred on all six visits while thoracic manipulation was only implemented once a week for three weeks (total of three thoracic manipulations). In the absence of an audible facet cavitation during the first manipulation, the PT would attempt a second manipulation after repositioning. No more than two attempts were allowed per session with or without an audible pop. The authors did not label a manipulation without an audible cavitation to be an un-successful intervention. Frequency of soft tissue massage was not specified. The authors did not elaborate on the specific technique or location regarding soft tissue massage as they did with the manipulation, thermal and electrotherapy.

Outcome Measures: Each group was clinically assessed at baseline and during the one-week follow-up. The two primary outcome measures that were relevant to my clinical question included the Numerical Pain Rating Scale (NPRS) and the Northwick Park Neck Pain Questionnaire (NPQ). NPRS scoring ranges from 0, indicating no pain to 10, indicating maximum pain. The authors did not state whether the NPRS was a reliable or valid outcome measure, but they did indicate that the minimal clinically important difference (MCID) was a 2-point change.

Upon further research, Jensen *et al.*² found the NPRS to be a reliable and valid outcome measure for patients with chronic pain. The NPQ is a tool to assess the perceived level of disability a patient is experiencing secondary to neck pain. The NPQ involves nine categories of activities of daily living that are scored on a scale from 0 to 4, 4 indicating maximum disability; the total possible score ranges from 0-36. Again, the authors did not state whether the NPQ was a reliable or valid outcome measure, nor did they mention the MCID. Further researching this matter, I located an article by Gonzalez *et al.*¹ that found the NPQ to be a reliable and valid outcome measure for patients with chronic neck pain. An article by Sim *et al.*⁴ determined that the MCID for the NPQ is a 25% reduction from the baseline score. The authors failed to mention any gold standard for measuring pain or disability.

Study Losses: Of the 43 subjects that participated in the study, there were no losses throughout the duration of the protocol or at the one-week follow-up.

Summary of Internal Validity: I determined that this study has good internal validity (PEDro 9/10). The authors utilized valid and reliable measures, concealed randomization and controls in an appropriate manner. The authors reported no study losses and there were no significant differences between groups at baseline. I found two possible threats, one of moderate significance and one of minor significance. The moderate threat involves the lack of therapist blinding to individual group allocation, which creates the potential for a biased treatment. Clinicians responsible for treating subjects may have provided added encouragement and attention to compensate for their allocation to the control group³. The minor threat involves the unspecified number of therapists responsible for treating the subjects. The potential would exist for treatment variability if the numbers of therapist were large, thus threatening the validity of the study.

Evidence: Gathered at baseline and during the 1-week follow-up, the data from the NPRS and the NPQ were most useful for me to determine the evidence regarding the efficacy of thoracic manipulation for decreasing pain and disability in patients with mechanical neck pain. Table 2 and 3 provides data regarding the change for the outcome measures. The specific changes I am interested in, are both the within group difference to ascertain the clinical effectiveness for satisfying the MCID, and the between group difference to assess which treatment protocol produces the greatest amount of change at the 1-week follow-up.

Table 2. Within-group mean changes and between-group mean difference in NPRS

	Mean Difference Within Groups (95 % CI)	Point estimate met MCID of 2 points?	Mean Difference Between Groups (95 % CI)
Manipulation group (n=23)	3.3 (2.7-3.9)	YES	2 (1.43 – 2.57)
Non-manipulation group (n=22)	1.07 (0.62-1.52)	NO	

The authors calculated that both groups showed statistically significant mean improvements from baseline scores on the NPRS. However, only the manipulation group’s mean improvement met the MCID (Table 2). Further analysis shows that 95% CI surrounding the mean change for was above the MCID. This indicates that upon subsequent identical studies, the manipulation group would consistently meet the MCID 95% of the time, thus proving the efficacy for making clinically significant changes in pain for patients with acute mechanical neck pain. Regarding the non-manipulation group, even the high end of the 95% CI does not meet the MCID, indicating that 95% of the time, this protocol does not have potential to meet the MCID for change in pain. The authors reported a statistically significant between-group mean difference (95% CI) of 2.3 (2-2.7), favoring the manipulation group. However, based on the data that the authors provided in the article, the between-group mean difference (95% CI) was 2 (1.43-2.57).

Table 3. Within-group mean changes and between-group mean difference in NPQ

	Mean Difference Within Groups (95 % CI)	Point estimate met MCID of a 25% reduction	Mean Difference Between Groups (95 % CI)
Manipulation group (n=23)	12.6 (10.33-14.87)	(6.95 pt. reduction) YES	7.7 (5.45-9.95)
Non-manipulation group (n=22)	4.2 (2.41-5.99)	(6.78 pt. reduction) NO	

Table 3 shows the within- and between-group mean differences in the NPQ. The authors calculated that both groups showed statistically significant mean improvements from baseline scores on the NPQ. However, similar to Table 2, only the manipulation group’s mean

improvement met the MCID. For the manipulation group, both the mean and the lower end of the 95% CI surrounding the mean were above the MCID. Again, similar to Table 2, this indicates that upon subsequent identical studies, the manipulation group would consistently meet the MCID 95% of the time. Regarding the non-manipulation group, even the high end of the 95% CI does not meet the MCID, indicating that 95% of the time, this protocol does not have potential to meet the MCID for change in disability. The authors reported a statistically significant between-group mean difference of 8.5 (7.2-9.8), favoring the manipulation group. Upon further independent calculation based on the values provided by the authors, the between-group mean difference (95% CI) was 7.7 (5.45-9.55).

Applicability of Study Results

Benefits vs. Costs: Analysis of the data proves the therapeutic efficacy of the addition of thoracic manipulation to a treatment protocol (soft tissue massage, electro and thermal modalities) for decreasing pain and disability. This study showed that improvements in pain and disability were both clinically meaningful, and significantly different when compared to a treatment plan that excluded 3 thoracic manipulations. Only the manipulation group met the MCID for both outcome measures during the one-week follow-up. Typical time allotment for the application of a thoracic manipulation should range from 2-3 minutes. This time allows for a brief explanation, positional set-up and patient authorization at the pre-manipulation hold. Therefore, applying the technique as outlined in this study for a total of 3 times would cost the clinician and the patient less than 10 minutes of treatment time to make such significant gains in pain and disability. The nominal cost together with the minor time allocation required to perform 3 thoracic manipulations, indicates that the addition of this manual technique is an effective and efficient intervention that should be considered when treating a patient with acute mechanical neck pain.

Feasibility of the Treatment: Each therapeutic intervention would be a feasible option for treating acute mechanical neck pain. All the interventions implemented are safe, accepted techniques that are both included in the curriculum of a Doctoral Physical Therapy program, and are also commonly covered options for continuing education. All the interventions except soft tissue massage were described with enough detail to be successfully replicated in clinical practice.

Summary of External Validity: The results can be appropriately generalized to patients with similar disability and pain as the internal validity of the study does not compromise the ability to do so. There was high similarity between the subjects and the type of patients that would be treated in most outpatient PT clinics. Acute mechanical neck pain is a chief complaint seen regularly by PT's and all the interventions of the study are commonplace within the practice of physical therapy.

Article 2: Mun Cheung Lau, H et al. The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain: A randomized controlled trial. *Manual Therapy*. 2011; 16:141-147.

Clinical Bottom Line: Based on the results of this randomized clinical study with 120 adults, there is strong evidence to support that for adults with chronic mechanical neck pain, a four-week intervention protocol involving 8-16 thoracic manipulations combined with infrared radiation and educational material (pathological explanation, exercise, and mobility training), resulted in significantly greater improvements in pain and disability when compared to an identical protocol that excluded the manipulations. The two reliable and valid outcome measures of interest used the Numerical Pain Rating Scale for pain and the Northwick Park Neck Pain Questionnaire for disability. There was a statistically significant difference between groups at both follow-up dates for both outcome measures, favoring the addition of thoracic manipulation. Only the manipulation group met the MCID for the NPRS (15% reduction) and the NPQ (25% reduction) at both follow-up dates, proving that the addition of the technique was clinically effective for decreasing pain and disability. The internal validity of this study was good (PEDro score 8/10) with two possible threats, one moderate and one minor. Based on this one study, the benefit of receiving thoracic manipulation outweighs the costs (*i.e.*, entry-level physical therapist training and an approximate maximum treatment time of 48 minutes). Additional research should incorporate multi-year follow-up in order to assess the long-term efficacy of thoracic manipulation for decreasing pain and disability. Additional research should also include more common interventions used for treating chronic neck pain along with thoracic manipulation (*e.g.*, therapeutic exercise/activity, postural re-education, other forms of manual therapy). This would allow for a more significant understanding regarding the power of thoracic manipulation in the context of more common interventions provided in an outpatient physical therapy clinic.

Article PICO:

Population: Adults 18-55 years of age with chronic (> three months) mechanical neck pain

Intervention: Thoracic manipulation, infrared radiation (IRR), educational material (pathological explanation, exercise, and mobility training; n=60)

Comparison: IRR, educational material (pathological explanation, exercise, and mobility training; n=60)

Outcome: Numerical pain rating scale (NPRS), Northwick Park Neck Pain Questionnaire (NPQ), cervical range of motion, Craniovertebral angle, health-related quality of life status (SF36 Questionnaire)

Blinding: The authors utilized an approach that incorporated only blinding of the single assessor to the treatment group of each subject who underwent assessment. The subjects were not blinded to their group allocation along with the interventions they would be receiving. PT's responsible for the application of the therapeutic interventions were also not blinded. See summary of internal validity below for potential threat analysis.

Controls: The non-manipulation group that received standard rehabilitation consisting of infrared radiation thermal therapy and educational material (pathological explanation, exercise, and mobility training) was the comparison group. The absence of a placebo group does not diminish the adequacy of the authors' selected control group because the only difference between the two groups was the inclusion of the grade V manipulation (*i.e.*, the independent variable). A placebo intervention is neither an accepted form of treatment, nor is it necessary for determining the clinical effectiveness of an intervention. Utilizing accepted treatment protocol helps PT's to establish a foundation based on clinical practice supported by empirical evidence.

Randomization: The authors utilized a convenience sample from a hospital-based outpatient physical therapy clinic. A total of 120 subjects were randomly allocated into the two treatment groups by a computer generated randomizing program. Individual group assignment cards were stored in opaque envelopes prior to dispersal, evidencing concealment. There were no significant differences between groups at baseline with respect to outcome measures, age and sex, indicating a successful randomization.

Study: 120 subjects with chronic mechanical neck pain participated in this randomized controlled trial. Inclusion criteria were adults between the ages of 18 and 55 years, with duration of symptoms lasting more than three months. Specific symptomatic description was not stated. Prospective subjects were excluded if they possessed any pathology that would deem manipulation contraindicated. Other exclusion criteria were past medical history of whiplash-associated disorders, surgical intervention for the cervical spine, fibromyalgia, past treatment history of spinal manipulation within two months and impaired standing balance. The experimental group (manipulation group; n=60) received thoracic manipulation, infrared radiation and educational material (pathological explanation, exercise, and mobility training). The control group (n=60) received the identical protocol as the experimental group with the exclusion of thoracic spine manipulation. The two groups received their intervention protocols during eight sessions of therapy over four consecutive weeks. The application of modality therapy occurred on all 8 visits. Based on information in Appendix 1, we can assume that following the last treatment on the 4th week, each subject received a minimum of eight and a maximum of 16 manipulations. Regarding thoracic manipulation treatment, in the absence of an audible facet cavitation during the first attempt, the PT would attempt a second manipulation after repositioning. No more than two attempts would have been allowed per session with or without an audible pop. However, the authors did state that an audible cavitation occurred during all manipulations. The authors did not elaborate on the specific parameters of the IRR as they did with the manipulation technique, nor did they discuss the type or model of the device used.

Outcome Measures: Each group was clinically assessed at baseline, during the final treatment on the eighth week, and at the three-month and six-month follow-up. The two primary outcome measures that were relevant to my clinical question included the Numerical Pain Rating Scale (NPRS) and the Northwick Park Neck Pain Questionnaire (NPQ). NPRS scoring ranges from 0, indicating no pain to 10, indicating maximum pain. The authors did not state

whether the NPRS was a reliable or valid outcome measure, but they did indicate that the minimal clinically important difference (MCID) was a 15% change. For the reliability, validity and MCIDs for both outcome measures, see Gonzalez-Iglesias *et al.* CAP.

Study Losses: Of the 120 subjects that participated in the study, all subjects received the specified treatment frequency and duration. Both groups sustained losses during all three follow-up sessions. At the immediate follow-up and at the three-month and six-month follow-up, the drop-out rate for the experimental group and the control group was (5% and 10%), (8.33% and 18.33%) and (10% and 18.33%), respectively. Reasons for subject absence included time restrictions, symptom exacerbation, dissatisfaction with the treatment and for other reasons unspecified. The control group consistently experienced a higher drop-out percentage at all follow-up dates. Special attention needs to be paid regarding the dissatisfaction reason given for subject absence; 15% of the control group stated they were dissatisfied, whereas only 5% of the experimental group expressed treatment dissatisfaction. Statistical calculation and imputation was performed to compensate for the missing data. As stated by the authors, no subjects were excluded from analysis by intention-to-treat.

Summary of Internal Validity: I determined that this study has good internal validity (PEDro 8/10). The authors utilized valid and reliable measures, concealed randomization and controls in an appropriate manner and there were no significant differences between groups at baseline. I found two possible threats, one of moderate significance and one of minor significance. The moderate threat involves the lack of therapist blinding to individual group allocation, which creates the potential for a biased treatment. Clinicians responsible for treating subjects may have provided added encouragement and attention to compensate for the allocation to the control group.³ The minor threat involves the unspecified number of therapists responsible for treating the subjects. The potential would exist for treatment variability if the numbers of therapist were large, thus threatening the validity of the study.

Evidence: I am interested in the data points gathered during the final treatment session on the fourth week, and at the six-month follow-up. The information obtained at the fourth week provides evidence regarding the immediate effect of both treatment protocols once the initial plan of care has been completed. The data gathered at the six-month follow-up provides evidence regarding the long-term efficacy of both treatment protocols for decreasing pain and disability. The data from the NPRS and the NPQ were most useful for me to determine the therapeutic efficacy of thoracic manipulation for decreasing pain and disability. Tables 4 and 5 provide the within-group mean changes in NPRS and NPQ and their relationship to MCIDs reported in the literature. The specific changes I am interested in are both the within-group differences to ascertain the clinical effectiveness for satisfying the MCID, and the between-group differences to assess which treatment protocol produces the greatest amount of change at all three follow-up dates.

Table 4. Within-group mean changes in NPRS at 4 weeks and 6 months

	Mean Change Within Groups (95 % CI) At 4 weeks	Point estimate met MCID of 15% change	Mean Change Within Groups (95 % CI) At 6 months	Point estimate met MCID of 15% change
Manipulation group (n=60)	1.88 (1.13-2.63)	YES	2.04 (1.83-2.57)	YES
Non-manipulation group (n=60)	0.68 (0.04-2.63)	No	0.81 (0.08-1.54)	YES

The authors calculated that both groups showed statistically significant mean improvements from baseline scores on the NPRS at four weeks and six months post-treatment. However, only the manipulation group's mean improvement met the MCID (Table 4) at four weeks and six months (37% and 41%). The non-manipulation group satisfied the MCID only at the 6-month follow-up (16% improvement). Further analysis regarding the manipulation group shows that the 95% CI surrounding the mean change was above the MCID at both follow-up dates. This indicates that upon subsequent identical studies, the manipulation group would consistently meet the MCID 95% of the time, thus proving the efficacy for making clinically significant changes in pain for patients with chronic mechanical neck pain. Regarding the non-manipulation group, the high end of the 95% CI at both follow-up dates meets the MCID (52% and 30%) for four weeks and six months, respectively), indicating that 95% of the time, this protocol has potential to meet the MCID for change in pain. However, the low end of the control group's interval falls below the MCID (0.8% and 1.6%) for four weeks and six months, respectively), allowing for the possibility to not meet the MCID.

The mean difference between groups was 1.23 (0.50-1.96) and 1.26 (0.51-2.01) at four weeks and six months, respectively. The authors reported that the between-group mean differences (95% CI) were statistically significant, favoring the manipulation group at each follow-up date.

Table 5. Within-group mean changes in NPQ at 4 weeks and 6 months

	Mean Change Within Groups (95 % CI) At 4 weeks	Point estimate met MCID of 25% change	Mean Change Within Groups (95 % CI) At 6 months	Point estimate met MCID of 25% change
Manipulation group (n=60)	12.00 (5.57-18.25)	Yes	10.38 (4.22-16.54)	Yes
Non-manipulation group (n=60)	5.85 (0.86-10.84)	No	7.06 (1.60-12.52)	No

Table 5 shows the within-group mean changes in the NPQ. The authors calculated that both groups showed statistically significant mean improvements only from baseline to the end of the fourth week. Only the manipulation group’s mean improvement met the MCID at the two follow-up dates (31% and 27% improvements). However, the low end of the 95% CI surrounding the mean did not meet the MCID at both follow-ups (14% and 11%, respectively). This indicates that upon subsequent identical studies, some of the individuals receiving the manipulation group’s interventions would not satisfy the MCID for decreasing disability. Regarding the non-manipulation group, the high end of the 95% CI at both follow-up dates (26% and 30%, respectively) met the MCID, indicating that 95% of the time, some of the individuals receiving this protocol would meet the MCID for improvement in disability.

The mean difference between groups on the NPQ at four weeks and six months was 8.86 (2.95-14.77) and 6.03 (-0.05-12.11), respectively. The authors reported that the between-group mean differences (95% CI) were statistically significant, favoring the manipulation group at both follow-up dates.

Applicability of Study Results

Benefits vs. Costs: Analysis of the data proves the therapeutic efficacy of the addition of thoracic manipulation to a treatment protocol (infrared radiation and educational material) for decreasing pain and disability. This study showed that improvements in pain and disability were both clinically meaningful, and significantly different when compared to a treatment plan that excluded the thoracic manipulations. Only the manipulation group met the MCID for both outcome measures during both follow-up dates. Typical time allotment for the application of a thoracic manipulation should range from 2-3 minutes. This time allows for a brief explanation, positional set-up and patient authorization at the pre-manipulation hold. Therefore, potentially applying the technique 8-16 times would cost approximately an additional 24-48 minutes over the course of a one month. In both cases, the necessary time allotment produces significant gains in pain and disability. This nominal cost together indicates that the addition of this manual

technique is an effective and cost-efficient intervention that should be considered when treating a patient with chronic mechanical neck pain.

Feasibility of the Treatment: Each therapeutic intervention would be a feasible option for treating chronic mechanical neck pain. All the interventions implemented are safe, accepted techniques that are both included in the curriculum of a Doctoral Physical Therapy program, and are also commonly covered options for continuing education. All the interventions except IRR therapy were described with enough detail to be successfully replicated in clinical practice.

Summary of External Validity: The results can be appropriately generalized to patients with similar disability and pain as the internal validity of the study does not compromise the ability to do so. There was high similarity between the subjects and the type of patients that would be treated in most outpatient PT clinics. Chronic mechanical neck pain is a chief complaint seen regularly by PT's and all the interventions of the study are commonplace within the practice of physical therapy. There is no reason to assume that subjects with chronic neck pain in Hong Kong would vary dramatically from those in the United States.

Discussion/Synthesis: The purpose of this critically appraised paper was to investigate the therapeutic efficacy of thoracic manipulation for decreasing pain and disability for adults diagnosed with mechanical neck pain (duration of symptoms less than one month to greater than three months). Based on the outcomes of the studies by Gonzalez et al. and Cheung et al., the addition of thoracic manipulation to a treatment protocol improves pain and disability with a greater magnitude when compared to a treatment protocol that excludes this intervention. Both articles demonstrated statistically significant improvements in pain and function in the protocols that utilized thoracic manipulation in conjunction with other interventions. The study by Gonzalez et al. (n= 45) demonstrated statistically significant improvements at the one-week follow-up in NPRS (pain) and NPQ (disability) in the group that received 3 thoracic manipulations in addition to electrotherapy, superficial heat and soft tissue massage in 6 sessions over 3 weeks. They also showed that a protocol that incorporated thoracic manipulation met the MCID for both the NPRS and NPQ during the one-week follow-up, demonstrating clinically significant decrease in pain and disability. The study by Cheung et al. (n=120) demonstrated statistically significant improvements after the final treatment session on the fourth week, and at the six-month follow-up on the NPRS and NPQ, with the addition of 8-16 thoracic manipulations in addition to infrared radiation and educational material (pathological explanation, exercise, and mobility training) during 8 sessions over 4 weeks. They also demonstrated that only the manipulation group satisfied the MCID for improvements in pain and disability at both follow-ups. The two articles utilized valid and reliable outcome measures and had good internal validity with only moderate or minor threats. Due to the good internal validity of both articles, I conclude that the results of these studies can be appropriately generalized to patients with similar dysfunction and pain. There is appropriate similarity between the subjects utilized in both articles and patients that would be commonly treated in an outpatient PT clinic in the United States. The therapeutic interventions applied in the studies are all accepted in most outpatient clinics as appropriate treatment interventions for chronic and acute mechanical neck pain. Based on these two studies, the benefit of

receiving 3-16 thoracic manipulations outweighs the costs of applying the technique. The information provided in this critically appraised paper must be considered when treating patients who suffer from mechanical neck pain with concomitant functional limitations. For those who do not possess the contraindications for grade V thoracic manipulation, including this intervention in a treatment plan is time-efficient and effective at decreasing pain and disability due to mechanical neck pain.

References:

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