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The effects of manual therapy and exercise for adults with temporomandibular joint disorders compared to electrical modalities and exercise

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The effects of manual therapy and exercise for adults with temporomandibular joint disorders compared to electrical modalities and exercise

Disciplines

Physical Therapy

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CRITICALLY APPRAISED TOPIC

Title: The effects of manual therapy and exercise for adults with temporomandibular joint disorders compared to electrical modalities and exercise.

Overall Clinical Bottom Line: Both of these articles supported the use of manual therapy in treating adults with TMD. However, the articles by Cuccia et al. and La Touche et al. are not very good matches to my clinical question, even though Cuccia et al. was of excellent quality (ranking 8/11 on the PEDro scale). Cuccia was a randomized controlled trial with 50 adults with TMD comparing osteopathic manipulation to conventional conservative treatment. La Touche et al. was a descriptive study following a cohort over a 12 week period looking at the response of manual therapy to the cervical spine. The results of these articles show statistical significant differences between baseline and end of treatment for active mouth opening. For improvements in pain, Cuccia et al. did not meet the MCID where as La Touche et al. did surpass the known MCID at both 48 hours and 12 weeks. The Cuccia et al. article had adequate internal validity, whereas La Touche et al. primary threat is a lack of control group and small sample size, decreasing the likelihood of any potential results and generalizing the results to the general clinical population. Although both articles showed statistical significance of functional mouth opening with the use of manual therapy, neither article directly addressed my clinical question, therefore further research is needed in order to accept any potential results. At this time these articles would not affect my treatment interventions for adults with TMJ.

Clinical Scenario: I recently had an initial evaluation of a patient with temporomandibular joint (TMJ) pain. The patient's onset of TMJ came on after a car accident a few years ago, where she also experienced cervical and upper thoracic pain as well as vestibular impairments. I was interested in finding the most effective treatment approach. I would like to determine whether manual physical therapy and exercise would give better results than the use of modalities (ultrasound or electrical stimulation) and exercise.

Clinical Question:

Population— Adults with TMJ pain or Temporomandibular joint disorder (TMD)

Intervention – Manual therapy and exercise

Comparison – Modalities (ultrasound or electrical stimulation) and exercise

Outcome – Pain (VAS), functional improvement in ROM

Search Terms: TMJ, TMD, manual therapy, massage, ultrasound, and electric stimulation

Appraised By: Ali Jakubowski SPT on February 7, 2010

Introduction

A temporomandibular joint disorder (TMD) occurs as a result of problems with the jaw, jaw joint and surrounding facial muscles that control chewing and moving the jaw. The pathogenesis of TMD is unknown.

The TMJ is a synovial, condylar and hinge-type joint with fibrocartilaginous surfaces rather than hyaline cartilage and an articular disc. The disc completely divides each joint into two cavities. The joint connects the lower jaw (mandible) to the temporal bone of the skull (Magee 1997). The joints are flexible, allowing the jaw to move smoothly up and down and side to side and enabling one to talk, chew and yawn. Muscles attach to and surround the jaw joint to control the position and movement of the jaw. The muscles include masseter, temporalis, medial pterygoid and later pterygoid (Neumann2002).

People with TMD can experience severe pain and discomfort that can be temporary or last for many years. More women (6.3%) than men (2.8%) experience TMD. TMD is most common in people between the ages of 20-40. The prevalence of TMD is between 3-15% in the Western population with an incidence between 2-4% (La Touchee 2009).

Symptoms associated with TMD are: pain or tenderness of the jaw, aching pain in and around the ear, difficulty chewing or discomfort while chewing, aching facial pain, locking of the joint, difficulty with opening or closing of the mouth, headaches, uncomfortable bite, or uneven bite because one or more teeth are making premature contact. Clicking, popping or grating sounds in the joint with opening and closing of the mouth; may or may not be accompanied with pain (mayoclinic.com 2011). Other common symptoms include toothaches, neck pain, dizziness, earaches and hearing problems (Magee, 1997).

TMD can be difficult to diagnose because of its signs and symptoms, which resemble a toothache, sinus problem, arthritis or gum disease. Therefore an examination by a dentist or doctor may be needed. Sometimes images will be taken. An x-ray of the full face will allow a dentist to view the entire jaw, TMJ and teeth to make sure other problems aren't causing symptoms. Magnetic resonance imaging (MRI) or a computer tomography (CT) may be needed. The MRI views the soft tissue such as TMJ disc to see if it is in the proper position as the jaw moves. A CT scan helps view the bony details of the joint (mayoclinic.com 2011).

Current treatments for TMD range from simple self-care practices and conservative treatments to injections and surgery. Most experts agree that treatment should begin with conservative, nonsurgical therapies first, with surgery left as the last resort.

Many electrotherapeutic treatments (transcutaneous electrical nerve stimulation (TENS), ultrasound (US), pulsed radio frequency energy (PRFE), iontophoresis, and laser) have been used as a component of physical therapy treatment for TMD. TENS provides pain relief by relaxing the jaw and facial muscles and US provides a deep heat to the TMJ to relieve soreness and improve mobility. Manual therapy includes accessory joint oscillatory mobilizations applied to the TMJ and massage to masseter and pterygoid muscles. One study found that mobilizations to the TMJ reduced pain and improve oral opening with anterior disc displacement (Carmeli et al., 2001).

Therefore, the purpose of this paper is to compare the use of electrotherapeutic modalities, such as TENS and US to manual therapy in conjunction with therapeutic exercises for the jaw of adults with TMD.

Article # 1: Cuccia, A.M., Caradonna, C., Annunziata, V., Caradonna, D. (2010) Osteopathic manual therapy versus conventional conservative therapy in the treatment of temporomandibular disorders: A randomized controlled trial. *Journal of Bodywork & Movement Therapies* 14:179-184.

Clinical Bottom Line: Based on the results of this study there is no significant evidence to suggest that adults with TMD or TMJ pain, have a better outcome with an intervention of osteopathic manual therapy (OMT) (myofascial release, balanced membranous tension, muscle energy, joint articulation, high-velocity, low-amplitude thrust and cranial-sacral therapy to the cervical and TMJ joints) when compared to conventional conservative therapy (CCT) (gentle muscle stretching and relaxing exercises, and modalities (hot/cold packs and transcutaneous electrical nerve stimulation)). The effect size (95% CI) between groups at 24 weeks for the visual analog scale (VAS) of TMJ pain is 1.41 indicating a real difference between groups. Whereas, at 32 weeks effect size between groups is 0.31 (-0.25 to 0.87) indicating a small effect that the treatment would have changed the results to either group, suggesting no statistical significance. Both functional outcome measures (maximum mouth opening (MOV) and cervical ROM) showed significant differences from baseline to 24 and 32 weeks, however, there is no known MCID for these outcome measures, therefore it is unknown if the improvements in these scores reflects a clinically meaningful improvement for either group. The study had adequate internal validity due to the successful randomization into groups, no dropouts and blinding of assessors. My primary concern is that this article does not directly address my clinical question. In this study the “control group” (CCT) also received the manual therapy (gentle massage) and electrical stimulation, which I was not interested in combination of manual therapy and electrical stimulation. I was more interested in the changes made between manual therapy and exercise compared to modalities and exercise. Each group received various therapeutic interventions making it difficult to attribute the changes in symptoms to particular interventions. The results of this study suggest that either intervention would be an option for treatment of TMD to improve functional outcomes. Further research is needed to compare manual therapy to electrical modalities in conjunction with exercise to find evidence related to my clinical question.

Population— 18-50 y.o. adults with a diagnosis of TMD

Intervention— Osteopathic manipulation

Comparison— Conventional conservative treatment (oral appliance, physical therapy, and modalities)

Outcomes— TMI, VAS, ROM (mouth & C-spine)

Blinding: The authors did not mention whether the subjects were blinded. Therefore, it is uncertain if the subjects were aware of whether they were in the treatment or control group. Blinding was done to the assessor who performed measurements at 24 and 32 weeks. There was one assessor who was blinded to treatment assignments.

Controls: The group that received conventional conservative therapy (CCT) served as the control group. The treatment included use of oral appliance, physical therapy (gentle muscle stretching and relaxing exercises), and modalities (hot/cold packs and transcutaneous electrical nerve stimulation).

Randomization: The subjects were randomly assigned to either the osteopathic manual therapy (OMT) group or CCT group, the authors did not describe method of randomization, so it is uncertain whether randomization was concealed. This randomization was successful as indicated by the fact that the groups did not have any significant differences at baseline.

Study: This was a prospective randomized controlled study of 50 subjects (28 females) obtained using convenience sampling from the department of Orthodontics & Gnathology during a six month period. The subjects were randomized into two groups of 25. Both groups underwent a standardized TMJ examination. The examination included rate of joint pain and crepitation. Uncoordinated head movements of the mandibular condyles during opening and closing of the mouth were investigated by lateral and posterior palpation of the TMJ. Inclusionary criteria included: temporomandibular index (TMI) reference value $>0.08 \pm 0.10$ and a minimum pain intensity of 40mm on a visual analogue scale (VAS). Exclusionary criteria included: history of adverse effects with osteopathic treatment, being under orthodontic treatment or under treatment for TMD, previous treatment for TMD, making regular use of analgesic or anti-inflammatory drugs, use of dental prosthesis, presence of any other oro-facial pain condition, neurological or psychiatric disorders and systemic inflammatory disorder. The OMT group received osteopathic manipulation by a doctor of osteopathy. Each treatment consisted of: myofascial release, balanced membranous tension, muscle energy, joint articulation, high-velocity, low-amplitude thrust and cranial-sacral therapy to the cervical and TMJ joints, lasting about 15-25 minutes per treatment session. The CCT group was treated by a gnathology specialist who treated with oral appliance, physical therapy (gentle muscle stretching and relaxing exercises), and modalities (hot/cold packs and transcutaneous electrical nerve stimulation). Both groups were allowed to take non-steroidal medication and/or muscle relaxants, when prescribed by their medical practitioner.

Outcome measures: Outcomes were measured at three time points: baseline, 24 weeks and 32 weeks. The outcome measures most relevant to my clinical question were the VAS and maximum mouth opening (MOV) and cervical ROM. The VAS (1-10) was used to measure the intensity of jaw pain. The authors did not mention a minimal clinical important difference (MCID) for VAS, MOV or cervical rotation ROM. However, the VAS has been validated in many other patient populations (Tashjian et al., 2009; Bird S.B. et al., 2001; Gallagher, E.J. et al., 2001). Although the authors did not discuss a threshold for a MCID on the VAS, the MCID has been reported as slightly greater than 30% change in the VAS. Thus, for this study, the MCID in the 10 point scale is roughly 3 points. No MCID was mentioned for MOV or cervical ROM, however functional ROM of mouth opening it is stated to be 25-35 mm and normal cervical rotation is between 70-90° (Magee, 1997, Hazel, 2000).

Study losses: 100% of subjects completed the intervention and were analyzed in the groups to which they were randomized at 24 and 32 weeks.

Summary of internal validity: Overall, this study had adequate internal validity. All subjects were successfully randomized into two groups and equal at baseline. In addition, blinding of assessors and no subject loss support good internal validity of this study. Although, the authors did not report the reliability of any of the outcome measures, further research has shown the VAS, MOV and cervical ROM to be reliable (Tashjian et al., 2009; Bird S.B. et al., 2001; Gallagher, E.J. et al., Magee, 1997, Hazel, 2000). Some threats to internal validity are that subjects and doctors/specialists were not blinded to group allocation. The primary threat to

internal validity was lack of a strict protocol allowing similar treatment implementation for both groups. Each group described general techniques used, but did not mention specifics of those techniques, making it difficult to determine what intervention provided relief and change in symptoms.

Evidence: VAS, MOV and cervical ROM were measured at the 24 and 32 week time points; I am most interested in immediate and long term effects after intervention.

Table 1: Comparison of osteopathic manual therapy and conventional conservative treatment effects on the visual analog scale at 24 and 32 weeks.

Average values and SD	Effect Size Between Groups [95% CI]	Mean Difference [95% CI]
24 weeks OMT 1.5 ± 0.85 CCT 2.6 ± 0.7	1.41[0.79 to 2.03]	1.1 [0.63 to 1.57]
32 weeks OMT 3.8 ± 1.26 CCT 4.4 ± 1.75	0.31[-0.25 to 0.87]	0.6 [-0.55 to 1.75]

Table 1 illustrates the effect size of the change scores between groups from baseline to 24 and 32 weeks. Because the authors did not present raw data for the VAS, average values and SD were extrapolated from baseline, 24 and 32 weeks due to notable similarities between groups at baseline. Confidence intervals (CI) surrounding the effect size between groups were calculated by the standard deviations noted in the article. Mean difference (95%CI) at 24 weeks is 1.1 (0.63 to 1.57) and 0.6 (-0.55 to 1.75) at 32 weeks, using the MCID of improvement of 3 points, neither group met the MCID at 24 weeks or 32 weeks. The effect size between groups, calculated at 24 weeks was 1.41 indicating a real difference between groups. Effect size between groups at 32 weeks is 0.31(-0.25 to 0.87) indicating a small effect size; therefore there is no statistical significance that the treatment would have changed the results to either group. Also, the 95% CI were negative indicating subjects' pain level could have increased due to the intervention.

Table 2: Comparison of osteopathic manual therapy and conventional conservative treatment effects of maximum mouth opening at 24 and 32 weeks.

Average values and SD	Effect Size Between Groups [95% CI]	Mean Difference [95% CI]
24 weeks OMT 46.0mm ± 4.78 CCT 41.3mm ± 4.52	1.01 [0.42 to 1.6]	4.7mm [1.91 to 7.49]
32 weeks OMT 42.9mm ± 2.69 CCT 40.4mm ± 2.41	0.98 [0.39 to 1.57]	2.5mm [0.97 to 4.03]

Table 2 illustrates the effect size of the change scores between groups from evaluation to 24 and 32 weeks. Again since the authors did not present raw data for the MOV, mean scores were extrapolated from baseline, 24 and 32 weeks due to notable similarities between groups at baseline. The mean difference between groups is 4.7mm and 2.5mm at 24 and 32 weeks, respectively. Since there is no known MCID for this outcome measure, it is unknown if the improvement in these scores reflects a clinically meaningful improvement for either group. However, the effect size between groups (95% CI) at 24 and 32 weeks is 1.01 (0.42 to 1.6)

and 0.98 (0.39 to 1.57) respectively. Indicating a, large effect size, between groups and there was no overlap of the 95% CIs for the effect size, suggesting a real difference between groups.

Table 3: Comparison of osteopathic manual therapy and conventional conservative treatment effects of cervical range of motion at 24 and 32 weeks.

Average values and SD	Effect Size Between Groups [95% CI]	Mean Difference [95% CI]
24 weeks OMT 81.9° ± 10.31 CCT 71.9° ± 9.05	1.03 [0.44 to 1.62]	10° [4.18 to 15.82]
32 weeks OMT 80.5° ± 5.44 CCT 72.4° ± 2.95	1.85 [1.19 to 2.51]	8.1° [5.47 to 10.73]

Table 3 illustrates the effect size of the change scores between groups from evaluation to 24 and 32 weeks. Once again, the authors did not present raw data for cervical ROM; mean scores were extrapolated from baseline, 24 and 32 weeks due to notable similarities between groups at baseline. The mean difference between groups is 10° (4.18 to 15.82) and 8.1° (5.47 to 10.73) at 24 and 32 weeks respectively. The authors did not report a known MCID for this outcome measure; therefore it is unknown if the improvement in these scores reflect a clinically meaningful improvement for either group. The effect size between groups (95% CI) is 1.03 (0.44 to 1.62) at 24 weeks and 1.85 (1.19 to 2.51) at 32 weeks demonstrating a large effect to treatment, suggesting a real difference between groups. The 95%CI for the between groups changes did not overlap, suggesting a significant difference between the groups.

Applicability of study results:

Similarity to my patients: The age ranges of subjects were a very good match to my clinical PICO. They were adults who were diagnosis with TMD which is a similar population seen in the clinic.

Benefits vs. Costs: Since both groups received the same number of treatment sessions, there would be no appreciable differences in financial costs. The evidence of this study shows improvements for both groups after 24 and 32 weeks in both functional outcomes (MOV and cervical ROM). There were no adverse responses reported to interventions.

Feasibility of treatment: The techniques and exercises program used in this study for both groups are very realistic for most clinical settings. However, the authors did not describe specific parameters for intervention outlines in either group making replication of treatment difficult. The subjects were treated every 2 weeks for 32 weeks or total of 16 total visits which is likely within the range insurance is willing to pay. There was no report by the authors or subjects of either intervention being painful.

Summary of external validity: The subjects sample is similar to patients treated in an outpatient orthopedic clinic and similar symptom presentations as seen in the clinic. Also, the use of convenience instead of random sampling slightly decreases the ability to generalize. The lack of a detailed description of the interventions undermines the ability for deciding whether it could be generalized to clinical practice.

Article # 2: La Touche, R., Fernandez-de-las-Pena, C., Fernandez-Carnero, J., Escalante, K., Angulo-Diaz-Parreno, S., Paris-Aleman, A. (2009) The effects of manual therapy and exercise directed at the cervical spine on pain and pressure pain sensitivity in patients with myofascial temporomandibular disorders. *Journal of Oral Rehabilitation* 36: 644-652.

Clinical Bottom Line: Based on the results of this study, there is sufficient evidence to suggest that adults with TMD who receive manual therapy and exercise focused to the cervical spine have a clinically meaningful difference in pain and active pain-free mouth opening. Although I was more interested in making a comparison with a control group that received electrical modalities and exercise, the purpose of this study was to assess the effects of joint mobilization directed at the cervical spine plus exercise targeting the deep cervical flexors muscles and their effects on pain and pressure pain sensitivity in the muscles of mastication in patients with TMD. My primary concern of this article is that it did not directly address my clinical question and had poor internal validity, due to lack of a control group and small sample size. Therefore one could not conclude a direct cause and effect relationship between the outcomes and the interventions directed at the cervical spine. Further randomized controlled trials are needed to compare manual therapy to electrical modalities in conjunction with exercise.

Population— Adults with TMD

Intervention— Cervical spine manual therapy and exercise

Comparison— no control

Outcomes— VAS, Active pain-free mouth opening, pressure pain threshold (PPT)

Blinding: There was no blinding in this study. Since there was only one group, the subjects could not be blinded to group allocation. For the same reasons, it was not necessary to blind the researchers.

Controls: There was no control group for comparison. The authors did a within-group pre- to post-treatment comparison looking at improvement in pain, active pain-free mouth opening and PPT.

Randomization: The study was nonrandomized.

Study: This was a single cohort study with 19 subjects (14 females and 5 males) between the ages of 19-57 years old (mean age 37 years) obtained using convenience sampling from four private dental clinics. Inclusionary criteria included: diagnosis of myofascial pain according to Axis I, Ia and Ib (i.e. myofascial pain with or without limited opening), bilateral pain involving the masseter and temporal regions, presence of at least one trigger point (TrP) in the masseter or temporalis muscles, pain symptoms history of at least the 3 months previous to the study, and intensity of the pain of at least 30 mm on a 100 mm VAS. Exclusionary criteria included: signs or symptoms of disc displacement, arthrosis, or arthritis of the TMJ, according to categories II and III of the RDC/TMD, history of traumatic injuries (i.e. fracture, whiplash), fibromyalgia syndrome, diagnosis of systemic disease (rheumatoid arthritis, systemic lupus erythematosus, or psoriatic arthritis), presence of neurological disorders (e.g. trigeminal

neuralgia), concomitant diagnosis of any primary headaches (tension-type headache or migraine) and subjects who had received any form of treatment (physiotherapy, splint therapy and acupuncture) within 3 months of the study. All subjects received treatment 2 times a week for 5 weeks for a total of 10 visits. All treatments were applied by the same physical therapist that specialized in manipulation therapy. Treatment included 1) upper cervical flexion mobilization which entails a mobilization at a slow rate of one oscillation per 2 seconds for a total of 10 minutes 2) C5 central posterior-anterior mobilization grade III at a rate of 2 oscillations per second for 9 minutes divided into 3 minute intervals with a 1 minute rest in between 3) Cranio-cervical flexor stabilization exercise: focus on deep flexor muscles of the cervical spine, following the protocol described by Jull et al.

Outcome measures: Outcomes were measured at three time points: baseline, 48 hours after last treatment and at 12 weeks follow up. The outcome measures most relevant to my clinical question were the VAS and active pain-free mouth opening. The authors reported the MCID threshold for VAS to be between 9-11 mm. The mean of three trials was calculated and used for the main analysis of active pain-free mouth opening. The authors reported high intra-test reliability of this test (ICC = 0.9 – 0.98).

Study losses: 100% of subjects completed the intervention and were analyzed 48 hours after last treatment and 12 weeks follow up.

Summary of internal validity: The primary threat to internal validity was the lack of a control group for comparison and small sample size. Without management of this threat, we cannot eliminate the confounding factors of history and maturation. The overall internal validity is strengthened by only one physical therapist performing the treatment maneuver, so there was not a concern of inter-performer reliability and addressing the reliability of the maneuvers and outcome measures. To improve the internal validity of this study, the researchers should have incorporated a sham control group for comparison and blinding.

Evidence: The study design was not a close match to my clinical PICO mainly because the authors were not making a comparison with a control group to determine the effect of manual therapy and exercise for treatment of TMJ. Instead, this was a descriptive study following a cohort over a 12 week period to look at the long-term response to manual therapy to the cervical spine. The authors reported a significant change in VAS of pain with mouth opening between baseline and both 48 hours after last treatment and 12 week follow up. However, no significant difference was found between 48 hours and the 12 week follow up. Using the MCID reported for the VAS of 9-11mm, both 48 hours and 12 week follow up periods were clinically meaningful as 20.9 ± 7.1 with a 95%CI of (17.5 to 24.4) and 18.7 ± 7.1 (15.3 to 22.1) exceeded the MCID respectively. Results also showed a large effect size as well as no overlapping of the 95% CIs suggesting a real difference from baseline. Again the authors found a significant difference between baseline and both 48 hours and 12 weeks for improvement in active pain-free mouth opening, but did not find any statistically significant difference between 48 hours after last intervention and 12 week follow up, due to maintenance of treatment effect. Since there is no known MCID for this outcome measure, it is unknown if the improvement in these scores reflect a clinically meaningful improvement. However, there was a large effect size between time periods suggesting a real difference as well as there was no overlap of the 95% CIs, therefore, suggesting that cervical spine manual therapy and exercise may be beneficial in decreasing pain and improving functional mouth opening for patients with TMD.

Applicability of study results:

Similarity to my patients: The age range of subjects and diagnostic criteria for TMD and referral by a dentist would be an acceptable fit for representing my clinical population.

Benefits vs. Costs: Manual therapy and exercise for the cervical spine is a high benefit, low-cost treatment for TMD. Since this was a single cohort study there was no difference in number a treatment sessions and therefore would be no appreciable differences in financial costs. The evidence of this study shows improvements from baseline to 48 hours and 12 week follow up. Even though there was no significant change from 48 hours to 12 weeks in pain or mouth opening, patients did not experience any reported adverse effects to the interventions or regression in their progress. There is no additional cost for equipment; if a biofeedback stabilizer is not available a blood pressure cuff can be used just as easily.

Feasibility of treatment: The use of manual therapy with exercises can easily be used in any clinic because it does not require additional equipment. The interventions can easily be replicated based on the authors' description and detailed protocol. The subjects were treated 2 times a week for 5 weeks for a total of 10 visits, which is likely within the range insurance is willing to pay. There was no report by the authors or subjects of the intervention being painful.

Summary of external validity: The subject sample is similar to patients treated in an outpatient orthopedic clinic with similar symptom presentations as seen in the clinic. Because the authors used convenience sampling instead of random sampling, we cannot be as confident that the results are truly representative of the general population seen in clinic. The lack of a control group undermines the ability to compare the effects of manual therapy and exercise for TMD to a clinical population.

Synthesis/Discussion

I assessed the methodological quality of these 2 studies using the PEDro scale.

Cuccia, et al. scored 8/11 providing adequate evidence for determining interventions in making changes in subjects with TMD. La Touche, et al. scored 5/11, which is low because it was a quasi-experimental study, but was more useful for descriptive protocol replication.

The eligibility criteria for articles chosen were somewhat broad to allow finding of 2 articles that were pertinent to my clinical question. When limiting my search to articles that were : in English, had subjects who were diagnosed with TMD or TMJ pain, included manual therapy and therapeutic exercise as one intervention and had a functional outcome measure of mouth opening and pain scale; it produced 1 RCT and 1 descriptive study that most closely matched my clinical PICO.

Both studies used manual therapy and therapeutic exercise as one of their interventions, Cuccia treated subjects over a 32 week period (16 visits) whereas La Touche treated subjects over a 5 week period (10 visits) for treatment of TMD/TMJ pain. Treatment parameter varied between articles. Cuccia et al. had a variety of general manual techniques directed at cervical spine and TMJ region; whereas La Touche et al. had specific manual techniques and exercises directed at the cervical spine. The Cuccia et al. article allowed subjects to use non-steroidal medication as part of the treatment. The follow-up time also varied between studies as Cuccia et al. reassessed after 24 weeks and 32 weeks; whereas La Touche et al. reassessed 48 hours after last treatment and 12 weeks.

Table 4 shows the mean difference from baseline to designated time periods of each study. Cuccia et al. did not meet the MCID at either time point and the 95% CI went negative indicating subjects' pain level could have increased due to the intervention. La Touche et al. mean change scores met the MCID for the VAS at both time periods demonstrating clinically significant improvements in pain levels with function. Neither study stated a known MCID for active mouth opening, however both studies reported a large effect size between time periods suggesting a real difference as well as no overlap of the 95% CI, therefore suggesting treatment to be effective in improving functional mouth opening.

Table 4: Comparison of mean difference of Visual Analog Scale and Active Mouth Opening

Articles		VAS Mean Decrease [95% CI]	Active Mouth Opening Mean Increase [95% CI]
Cuccia et al.	24 wks.	1.1 [0.63 to 1.57]	4.7 mm [1.91 to 7.49]
	32 wks.	0.6 [-0.55 to 1.75]	2.5 mm [0.97 to 4.03]
LaTouche et al.	48hrs	20.9 mm [17 to 24.4]	42.8 mm [41.5 to 44.1]
	12 wks.	18.7 mm [15.3 to 22.1]	43.1 mm [41.7 to 44.5]

Both studies yielded evidence for incorporating manual therapy directed at the cervical spine and TMJ as an intervention for adults with TMD or TMJ pain. However, further research is needed with a more appropriate control group, in order to accept any potential results and generalize the results to general clinical population.

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