Annals of R.S.C.B., ISSN: 1583-6258, Vol. 24, Issue 2, 2020, Pages. 660 - 671
Received 24 October 2020; Accepted 15 December 2020

Treatment Prostheses in TMJ Dysfunction-Pain Syndrome: Systematic Review &Meta Analysis

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ABSTRACT

Manual therapy (MT) and exercise have been extensively used to treat people with musculoskeletal conditions such as temporomandibular disorders (TMD). The evidence regarding their effectiveness provided by early systematic reviews is outdated. The aim of this study was to summarize evidence from and evaluate the methodological quality of randomized controlled trials that examined the effectiveness of MT and therapeutic exercise interventions compared with other active interventions or standard care for treatment of TMD.

Material and methods: Electronic data searches of 6 databases were performed, in addition to a manual search. Randomized controlled trials involving adults with TMD that compared any type of MT intervention (eg, mobilization, manipulation) or exercise therapy with a placebo intervention, controlled comparison intervention, or standard care were included. The main outcomes of this systematic review were pain, range of motion, and oral function. Forty-eight studies met the inclusion criteria and were analyzed.

Results: The overall evidence for this systematic review was considered low. The trials included in this review had unclear or high risk of bias. Thus, the evidence was generally downgraded based on assessments of risk of bias. Most of the effect sizes were low to moderate, with no clear

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indication of superiority of exercises versus other conservative treatments for TMD. However, MT alone or in combination with exercises at the jaw or cervical level showed promising effects. Conclusions: No high-quality evidence was found, indicating that there is great uncertainty about the effectiveness of exercise and MT for treatment of TMD.
Key words: Temporomandibular disorders (TMD),TMJ dysfunction-pain syndrome,Prostheses.

INTRODUCTION

Temporomandibular disorders (TMD) are commonly associated with other symptoms affecting the head and neck region, such as headache, ear-related symptoms, cervical spine dysfunction1-4 and altered head and cervical posture.5–15Physical therapy has been used for decades for treating craniomandibular disorders using thermal packs vapocoolants, and transcutaneous electrical nerve stimulation (TENS).16 Physical therapy is among the 10 most commonly used treatments for TMD,19 focused on decreasing neck and jaw pain, improving range of motion (ROM), and promoting exercise to maintain healthy function.20Therapeutic exercise and MT are used to improve strength, coordination, and mobility and to reduce pain,21 and treatment may include and focus on poor posture, cervical muscle spasm or pain, and treatment for referred cervical origin orofacial pain (pain referred from upper levels of the cervical spine).22 The evidence for the effect of electrophysical modalities has been questioned.23Manual therapy (including joint mobilization, manipulation, or treatment of the soft tissues) and therapeutic exercises in physical therapy treatments have been increasingly used by clinicians and researched due to positive outcomes in some conditions, especially for low back pain, neck pain, and related disorders.24 Most of these early systematic reviews highlighted the positive effects of exercises and MT to improve symptoms and function in people with TMD. Therefore, the objectives of this systematic review were: (1) to summarize the evidence from and evaluate the methodological quality of RCTs that examined the effectiveness of MT and therapeutic exercise interventions in the management of TMD and (2) to determine the magnitude of the effect of these interventions to manage TMD.

MATERIAL AND METHODS

This review was restricted to trials with participants meeting the following criteria: (1) diagnosis of TMD (2) adult (>18 years of age), (3) musculoskeletal dysfunction, (4) pain impairment, (5) no previous surgery in the temporomandibular region, and (6) no other serious comorbid conditions (eg, fracture in region, cancer, neurological disease).The primary outcomes of interest for this systematic review were pain, ROM, and oral function. Oral function for this systematic review focused on limitations of daily activities of patients with TMD measured through different questionnaires. A secondary outcome of interest was pressure pain threshold (PPT).This systematic review was open to all time points: immediately posttreatment and short-term, intermediate-term, and long-term follow-up.

Quality Assessment (Risk of Bias)

Assessments of quality (risk of bias) were completed by 2 independent reviewers (any 2 members of the research team). Any discrepancies in quality ratings were resolved by discussion. (95% CI) to pool data. Heterogeneity was evaluated statistically using the I2 statistic.

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RESULTS

The search of the literature resulted in a total of 3,549 published articles. 45 studies were included for this review from the search of the databases. In addition, 3 studies were obtained through a manual search, total 48 of studies were included in the final analysis (Fig. 1). Details of included studies are provided in Table 1.

Diagnosis

There was considerable diversity in the clinical presentations and diagnoses of participants with TMD among the included studies. Fourteen of the studies examined the effectiveness of the exercise or MT interventions in muscular TMD (myogenous TMD), 14 studies examined the effectiveness in patients with articular TMD (arthrogenous TMD), and 19 studies examined the effectiveness in patients with mixed diagnoses of TMD (including both myogenous and arthrogenous TMD).28,29 One study looked at both myogenous and arthrogenous TMD.58 Twenty-one of the studies57–76 used the RDC/TMD established by Dworkin and LeResche27 to classify the patients as having TMD. The remaining 27 studies used their own diagnostic criteria, based on signs and symptoms of the patients.

Effectiveness of Intervention by TMD Diagnoses: Posture Correction Exercise Myogenous TMD

Two studies evaluated the effectiveness of posture correction exercises for patients with myofascial pain. Both studies showed positive results of postural exercises for improving symptoms of muscular TMD. When pooling the data for these 2 studies, which had similar interventions, diagnoses, and outcomes, maximum pain-free mouth opening significantly increased in patients receiving postural training compared with a control group. The MD in maximum pain-free mouth opening was 5.54 mm (95% CI=2.93, 8.15) (Fig. 2), which was clinically significant in favor of postural training.

Manual Therapy Targeted to the Orofacial Region in Myogenous TMD

Four studies looked at MT techniques, such as facial manipulation versus botulinum toxin81 or intraoral myofascial therapy versus waiting list, and self-care education and exercises for people with myogenous TMD. The results of these studies support the use of MT to treat myogenous TMD, as people treated with all of these approaches had improved mouth opening and reduced jaw pain from baseline. Although the results for the intraoral myofascial therapy and exercise groups were superior to the results for the waiting-list control group, there was no statistically significant difference between them.

Although the results were mixed, most of the studies favored the use of exercises alone or as part of a general regimen to treat people with arthrogenous TMD, including disk displacements with or without reduction. However, one study61 did not find that exercises were superior to a control group involving general physical therapy treatment.

General Jaw Exercise Program in Mixed TMD

Eleven studies looked at exercises alone or as part of a general conservative therapeutic regimen to treat patients with mixed TMD. In general, exercises for mixed TMD compared with control groups had better results for decreasing pain and improving function and pain sensitivity of the masticatory muscles. However, compared with other forms of active treatments, such as splints, a global postural re-education program, or acupuncture, no significant differences between these treatments were found.

When pooling the results of studies with available data and similar interventions and outcomes, we found that exercises in the form of general jaw exercises plus conventional treatment or with

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the addition of an oral device94 were not superior to other treatment modalities, such as splint therapy, global re-education posture, splint plus counseling, acupuncture, or standard conservative care, in improving pain intensity. The SMD for pain intensity was −0.06 (95% CI=−0.50, 0.38), with a very small effect size according to Cohen's guidelines.

The overall quality of evidence for most comparisons was low to moderate according to the GRADE approach.49 The trials included in this review had unclear or high risk of bias. Thus, the evidence was generally downgraded for 3 reasons: (1) risk of bias, 2) level of heterogeneity (inconsistency), and (3) some imprecision surrounding the effect estimate. Details of GRADE assessment of the included studies are displayed in the Table. From the 14 analyses performed, most of the evidence was considered moderate (9 analyses). The rest of the evidence was considered low. Thus, we can say that the total evidence was considered low.

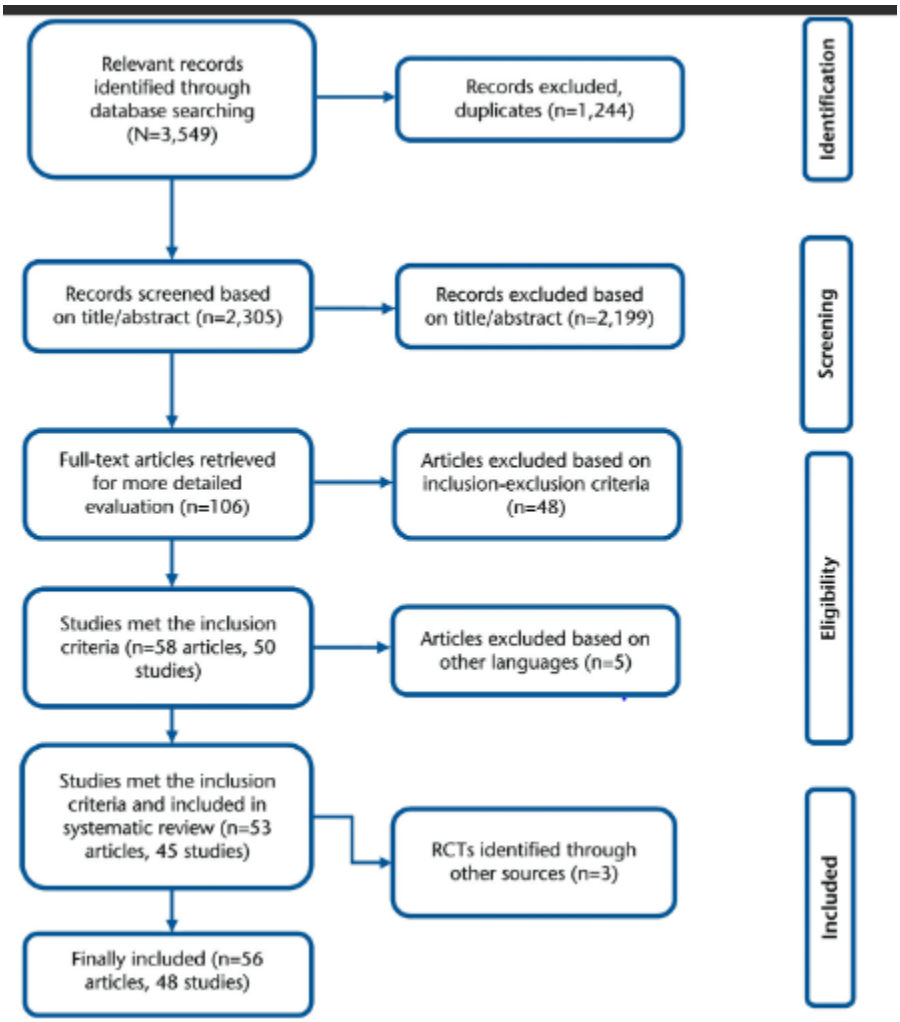

Figure 1: Flow chart of the study selection.

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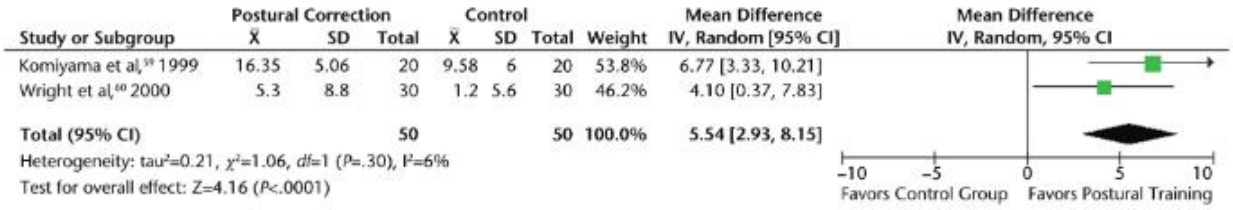

Figure 2. Maximum pain-free opening: postural training versus control group in patients with myogenoustemporomandibulardisorders.CIconfidence interval, IVinverse variance

Quality Assessment						Summary of Findings: Number of Patients			
Number of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Patients in Treatment Group	Patients in Control Group	Estimate (SMD or MD) [95% CI]	Quality
Posture Correction Exercises in Myogenous TMD									
Outcome: maximum pain-free opening									
2 (RCTs)	Unclear risk of bias for both studies. Concealment of allocation not clear for both studies, no intention-to-treat analysis.	*P* value on test for heterogeneity *P*=.30, I^2=6% No inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	50	50	MD=5.54 mm [2.93, 8.15]	Moderate quality because of risk of bias
Outcome: disturbance of symptoms with daily life									
2 (RCTs)	Unclear risk of bias for both studies. Concealment of allocation not clear for both studies, no intention-to-treat analysis.	*P* value on test for heterogeneity *P*=.15, I^2=51% No serious inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	50	50	SMD=1.13 [0.48, 1.78]	Moderate quality because of risk of bias. Upgrading because of large effect size and narrow CI.
General Jaw Exercises Alone or Combined With Exercise Program in Myogenous TMD									
Outcome: pain-free maximum opening									
4 (RCTs)	Unclear risk of bias for most of the studies. Concealment of allocation not clear for 3 studies, and 1 study was not concealed. All studies did not perform intention-to-treat analysis.	*P* value on test for heterogeneity *P*<.00001, I^2=88% High heterogeneity	No serious indirectness	No serious imprecision	No serious publication bias	64	67	MD=5.94 mm [−1.0, 12.87]	Low quality because of risk of bias and inconsistency
Outcome: pain intensity									
5 (RCTs)	High risk of bias for most of the studies. Concealment of allocation not clear for 4 studies, and 1 study was not concealed. Adherence and cointerventions unclear for most of the studies. No intention to treat for 4 studies	*P* value on test for heterogeneity *P*=.10, I^2=49% No serious inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	85	90	SMD=0.43 [−0.02, 0.87]	Moderate quality because of risk of bias

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Manual Therapy Targeted to the Orofacial Region in Myogenous TMD									
Outcome: pain intensity									
3 (RCTs)	Concealment of allocation not clear for 2 of the studies, and 1 study was not concealed. Adherence and cointerventions unclear for all of the studies. No intention to treat for 2 studies.	*P* value on test for heterogeneity *P*=.78, I^2=0% No serious inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	44	44	MD=1.35 cm [0.91, 1.78]	Moderate quality because of risk of bias
Jaw/Neck Exercises Alone or as Part of a Conservative Regimen in Arthrogenous TMD									
Outcome: pain intensity									
4 (RCTs)	Concealment of allocation not clear for all of the studies. Blinding was unclear for 3 of the studies, and 1 study did not have appropriate blinding. Adherence and cointerventions unclear for all of the studies. No intention-to-treat analysis for 2 studies.	*P* value on test for heterogeneity *P*=.01, I^2=73% High inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	73	73	SMD=0.68 [−0.04, 1.40]	Low quality because of risk of bias and inconsistency
Outcome: active mouth opening									
3 (RCTs)	Concealment of allocation not clear for all of the studies. Blinding was unclear for 2 of the studies, and 1 study did not have appropriate blinding. Adherence and cointerventions unclear for all of the studies.	*P* value on test for heterogeneity *P*=.009, I^2=79% High inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	63	63	3.13 mm [−1.96, 8.23]	Low quality because of risk of bias and inconsistency
Jaw/Neck Exercises Alone or as Part of a Conservative Regimen vs Surgery in Arthrogenous TMD									
2 (RCTs)	Concealment of allocation not appropriate for both studies. Blinding was not appropriate for both studies. Adherence and cointerventions unclear for both studies.	*P* value on test for heterogeneity *P*=.04, I^2=76% High inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	68	63	MD=−1.01 mm [−5.43, 3.42]	Low quality because of risk of bias and inconsistency
Outcome: pain intensity									
5 (RCTs)	Concealment of allocation unclear for most of the studies. Blinding was appropriate for most of the studies. Adherence unclear for most of the studies. No or unclear intention to treat for 2 studies.	*P* value on test for heterogeneity *P*=.58, I^2=0% No inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	99	114	SMD=0.40 [0.13, 0.68]	Moderate quality because of risk of bias
Outcome: active mouth opening									
4 (RCTs)	Concealment of allocation unclear for all of the studies. Blinding was appropriate for most of the studies. Adherence unclear for all of the studies.	*P* value on test for heterogeneity *P*=.93, I^2=0% No inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	75	77	3.58 mm [1.46, 5.70]	Moderate quality because of risk of bias
General Jaw Exercise Program in Mixed TMD									
Outcome: pain intensity									
5 (RCTs)	Concealment of allocation unclear for 4 of the studies. One study did not have appropriated allocation concealment. Appropriate blinding was unclear for most of the studies. Adherence and cointerventions unclear for all of the studies.	*P* value on test for heterogeneity *P*=.14, I^2=41% No serious inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	81	81	SDM=−0.06 [−0.50, 0.38]	Moderate quality because of risk of bias
Outcome: mouth opening									
7 (RCTs)	Concealment of allocation unclear for 4 of the studies. Three studies did not have appropriate allocation concealment. Appropriate blinding was unclear for most of the studies. Adherence and cointerventions unclear for all of the studies. Most of the studies did not perform an intention-to-treat	*P* value on test for heterogeneity *P*=.85, I^2=0% No inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	132	138	MD=−0.25 [−2.08, 1.57]	Moderate quality because of risk of bias

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Outcome: mouth opening									
2 (RCTs)	Concealment of allocation unclear for both studies. Appropriate blinding was unclear for one study. Intention to treat unclear for one study.	*P* value on test for heterogeneity *P*=.000001, I^2=100% Serious inconsistency	No serious indirectness	Moderate imprecision	No serious publication bias	47	49	MD −17.33 mm [−10.39, 45.08]	Low quality because of risk of bias, inconsistency, and imprecision
Manual Therapy Plus Exercises for Mixed TMD									
Outcome: mouth opening									
2 (RCTs)	Concealment of allocation unclear for both studies. Appropriate blinding was unclear for one study and not appropriate for the other study. Intention to treat unclear for one study and not performed by the other study.	*P* value on test for heterogeneity *P*=.02, I^2=82% Serious inconsistency	No serious indirectness	No serious imprecision	No serious publication bias	42	41	MD −6.10 mm [1.11, 11.09]	Moderate quality because of inconsistency

Table 1: Characteristics of the studies

DISCUSSION

Although the quality of the evidence is mostly uncertain and low, the results of our systematic review showed positive results when using postural exercises and jaw exercises to treat both myogenous and arthrogenous TMD disorders. Manual therapy alone or in combination with exercises shows promising effects. Manual therapy targeted to the cervical spine decreased pain and increased mouth ROM in patients with myogenous TMD. Exercises did not show superiority over other treatments for treating mixed TMD. A general exercise program was effective compared with arthrocentesis or arthrography for treatment of arthrogenous TMD, with conservative treatments as a first line of treatment. There remain limited RCTs of high quality that have investigated the effectiveness of MT and exercises to treat TMD.

Effect of Exercise for Treating TMD

Exercise programs are advocated for treating people with musculoskeletal disorders. Therapeutic exercises are prescribed to address TMD. Passive and active stretching of muscles are performed to increase mouth ROM and reduce pain. Postural exercises are helpful.21 The results of our systematic review are consistent with previous reviews,19,23 showing positive effects when using exercises to treat myogenous and arthrogenous TMD. In particular, interventions including exercises to correct head and neck posture and active and passive oral exercises can be effective for reducing musculoskeletal pain and improving oromotor function.51

Methodological Elements and Overall Quality of the Evidence Affecting Observed Effect

The overall rating of the evidence for this review was low. This finding was due mainly to the risk of bias of the analyzed studies. The methodological biases common to the included studies could have an impact on results. Selection bias could have existed, as only 20 trials reported appropriate randomization and only 4 reported concealment of allocation.

Another important bias was the lack of blinding, especially of the patients and assessors. Only 12 studies used blinded assessment of clinician-assessed outcomes such as mouth opening. However, we also were interested in pain, which is a subjective outcome and dependent on the patient's report. It is likely that lack of blinding could have affected the results of these studies. However, because of the nature of the interventions investigated, blinding would not be possible in many of them. There is empirical evidence showing that trials without appropriate randomization, concealment of allocation, and blinding tend to report an inaccurate treatment effect compared with trials that include these features.109 Thus, the results

of this systematic review should be interpreted with caution, especially in trials with subjective self- reported outcomes.

Studies did not report interventions in sufficient detail to be reproducible. In addition, they did not control for cointerventions and did not have adequate adherence to treatment. These issues are of importance for this study, as it is unclear if the effects on selected outcomes were due to the effect of exercise, MT, or other cointerventions. In addition, it is unclear if the participants received enough dosage of treatments, as adequate adherence was accomplished by only a very small proportion of studies (15.2%). Adherence testing should be systematically studied in future studies with exercise prescriptions.

The present study used a compilation of items from all of the scales used in the reviewed physical therapy literature in addition to the risk of bias tool. Our recent analysis of health scales used to evaluate methodological quality determined that none of these scales are adequate for use alone.44,111 Therefore, we decided to use all of the scales, using a compilation of their items, to provide a comprehensive and sensitive evaluation of the quality of individual trials. Research investigating methodological predictors for determining trial quality in physical therapy is needed.

There is the potential for selection bias, yet our group used a comprehensive search strategy and included databases as well as manual search.

CONCLUSION

Although the overall level of evidence is low, exercises and MT are safe and simple interventions that could potentially be beneficial for patients with TMD. Active and passive exercise for the jaw, postural exercises, and neck exercises appear to have favorable effects for patients with TMD. Manual therapy alone or in combination with exercises shows promising effects. Exercises did not show clear superiority over other conservative treatments for TMD

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