

## CRITICALLY APPRAISED TOPIC

### FOCUSED CLINICAL QUESTION

Is physical therapy combined with psychological intervention more effective than physical therapy alone in relieving pain and restoring function to the TMJ in a healthy 23-year-old female with chronic temporomandibular pain and dysfunction?

### AUTHOR

<b>Prepared by</b>	Hannah Manik	<b>Date</b>	December 4 <sup>th</sup> , 2018
<b>Email address</b>	hannah_manik@med.unc.edu		

### CLINICAL SCENARIO

A 23-year old female was referred to physical therapy with chronic left temporomandibular joint (TMJ) pain and dysfunction. The patient's symptoms began 1.5 years prior during a stressful life transition and were not relieved by a night guard and standard dental management. Her PT examination revealed reduced opening ROM, painful soft tissue restrictions in her left masseter and pterygoids, forward-head posture, and joint noises indicative of anterior disc displacement.

This patient demonstrated ROM improvements almost immediately following each treatment appointment, which consisted of ~80% manual therapy and ~20% postural and motor control exercises. However, she only maintained a small fraction of the improvement between appointments. She voiced concern that involuntary "clenching" in her sleep was generating muscle tension and limiting her progress in PT. Interestingly, she started maintaining ROM improvements after beginning psychotherapy.

A growing body of evidence suggests that psychological variables modulate chronic pain treatment outcomes.<sup>1,2</sup> Furthermore, psychological and behavioural interventions combined with traditional PT appear have a synergistic effect on improving disability status in chronic pain patients.<sup>2</sup> This patient case serves as limited evidence that these findings may extend to the management of chronic temporomandibular disorders (TMD). Thus, it is reasonable to believe that chronic TMD patients may benefit from a multimodal approach that combines traditional physical therapy and psychological interventions. Additional evidence that substantiates this claim may help PTs individualize treatment for TMD patients to enhance therapy outcomes.

### SUMMARY OF SEARCH

[Best evidence appraised and key findings]

- Eight articles were located that inclusion/exclusion criteria, including 6 systematic reviews, 2 randomized controlled trials, 1 quasi-experimental study, and 1 narrative review.
- The literature search did not yield any results that directly compared the effectiveness of traditional PT with and without the concurrent use of a psychological intervention for management of chronic TMD.
- There is some evidence to support the efficacy of active jaw exercises, manual therapy, postural training, EMG biofeedback, relaxation techniques, and behavioral interventions for management of TMD.
- Overall, evidence regarding PT management of TMD is limited in quantity and quality. Poor methodological quality, heterogeneity of data, and highly variable diagnostic criteria & outcome measures limit what conclusions can be drawn.

### CLINICAL BOTTOM LINE

The limited evidence available suggests that a 23-year old female with chronic TMD may benefit from some combination of traditional physical therapy and/or psycho-behavioral interventions (e.g. EMG biofeedback, relaxation training,) though the relative efficacy of interventions is unknown. Due to chronicity of TMD, this patient may benefit from an assessment of psychological status and a multimodal treatment. However, additional evidence with standardized methods and higher methodological rigor is needed to elucidate the efficacy of individual treatments for different sub-populations of TMD.

***This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor***

*The above information should fit onto the first page of your CAT*

## SEARCH STRATEGY

Terms used to guide the search strategy			
Patient/Client Group	Intervention (or Assessment)	Comparison	Outcome(s)
Temporomandibular disorder*	Joint mobilization*	Cognitive-behavioral therapy (CBT)	Pain
Temporomandibular dysfunction*	Manual therapy	Cognitive therapy	Function
Temporomandibular joint	Manipulation*	Psychology	Range of motion
Jaw pain	Physical therapy	Psychosocial	
	Physiotherapy	Psychological	
	Rehabilitation		

### Final search strategy (history):

Show your final search strategy (full history) from PubMed. Indicate which "line" you chose as the final search strategy.

- 1) Temporomandibular disorders [MeSH terms]
- 2) "Joint mobilization\*" OR "manual therapy" OR manipulation
- 3) "Cognitive behavioral therapy" OR "cognitive therapy"
- 4) "psychotherapy" OR "psychosocial" OR "behavioral"
- 5) Pain OR function OR "range of motion"
- 6) #1 AND #2 AND #3 AND #5
- 7) #1 AND #2 AND #4 AND #5
- 8) #1 AND #2 AND (#3 OR #4) AND #5
- 9) Psychology OR psychological OR psychosocial
- 10) Rehabilitation OR "physical therapy" OR physiotherapy
- 11) #1 AND #9 AND #10 AND #5**

Filters: Systemic review, randomized controlled trial, meta-analysis, clinical trial, review, full text, From 2005/01/01 to 2018/12/31

In the table below, show how many results you got from your search from each database you searched.

Databases and Sites Searched	Number of results	Limits applied, revised number of results (if applicable)
<b>PubMed</b>	<b>189</b>	<b>30-</b> Applied filters: published 2005-2018; full text available; article types- RCT, review, systematic review, clinical trial, meta-analysis <b>3-</b> Limited to full text, published 2005 and after <b>55-</b> Applied filters: Age-adult; Diseases-temporomandibular joint disorder, chronic pain; Publication year: 2005+
<b>CINAHL</b>	<b>24</b>	
<b>Embase</b>	<b>132</b>	

### INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
<ul style="list-style-type: none"> <li>• Adult subjects (18-65 years old) with chronic TMD symptoms (&gt;3 months)</li> <li>• Measured change in pain, function, and/or ROM with intervention</li> <li>• Randomized-controlled trials, clinical trials, systematic reviews, meta-analyses, narrative reviews</li> <li>• Available in English</li> </ul>
Exclusion Criteria

- Abstracts
- Articles published before 2005
- Subject size <30
- Subjects have comorbidity with TMD (e.g. fibromyalgia)

## RESULTS OF SEARCH

### Summary of articles retrieved that met inclusion and exclusion criteria

*For each article being considered for inclusion in the CAT, score for methodological quality on an appropriate scale, categorize the level of evidence, indicate whether the relevance of the study PICO to your PICO is high/mod/low, and note the study design (e.g., RCT, systematic review, case study).*

Author (Year)	Risk of bias (quality score)*	Level of Evidence**	Relevance	Study design
de Freitas (2013) <sup>3</sup>	AMSTAR score: 4/11	Level 1a	Mod-High	Systematic Review of Randomized Controlled Trials
Friction (2010) <sup>4</sup>	AMSTAR score: 7/11	Level 1a	Low	Systematic Review of Methods used in RCTs
List (2010) <sup>5</sup>	AMSTAR score: 8/11	Level 1a	High	Systematic Review of Systematic Reviews and Meta-Analyses
Litt (2010) <sup>6</sup>	PEDro score: 8/11	Level 1b	Mod	Prospective Randomized Controlled Trial
Turner (2006) <sup>7</sup>	PEDro score: 8/11	Level 1b	Mod	Prospective Randomized Controlled Trial
Medlicott (2006) <sup>8</sup>	AMSTAR score: 4/11	Level 2a (downgraded due to inclusion of nonrandomized controlled trials)	Mod-High	Systematic Review of Randomized Controlled Trials and Nonrandomized Controlled Trials
Jochum (2015) <sup>9</sup>	RoBANS: High Risk	Level 4	High	Quasi-Experimental: Longitudinal, repeated measures, non-equivalent control group design
Beuscher (2007) <sup>10</sup>	N/A	Level 5	High	Narrative Review

\*Indicate tool name and score

\*\*Use Portney & Watkins Table 16.1 (2009); if downgraded, indicate reason why

### BEST EVIDENCE

The following 2 studies were identified as the 'best' evidence and selected for critical appraisal. Rationale for selecting these studies were:

- **List et al. (2010)<sup>5</sup>** – This systematic review provides Level 1a evidence that is of high-relevance to the PICO question due to its consideration of the efficacy of both psychological/behavioural and physical therapy interventions. Its AMSTAR score suggests that it has a low risk of bias.
- **Medlicott et al. (2006)<sup>8</sup>** – This systematic review provides Level 2a evidence of moderate to high relevance to the PICO question. It reviews the efficacy of numerous physical therapy interventions, including some that are psychological/behavioural in nature (e.g. relaxation training, biofeedback), but does not include other psychological interventions. However, all of these interventions fall under the scope of PT practice, which makes this more applicable to the PICO question than any of the other six remaining articles.

## SUMMARY OF BEST EVIDENCE

### (1) Description and appraisal of "Management of TMD: evidence from systematic reviews and meta-analyses" by List et al. 2010.<sup>5</sup>

<b>Aim/Objective of the Study/Systematic Review:</b>
The aim of this systematic review is to (i) summarize and (ii) evaluate the methodological quality of systematic reviews and meta-analyses regarding the efficacy of various interventions for managing TMD.
<b>Study Design</b> [e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant] Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.
List et al. is a systematic review of systematic reviews and meta-analyses on the management of TMD. <b>Search Strategy:</b> A literature search was performed in the PubMed, Cochrane Library, and Bandolier databases. The search was limited to articles published between January 1, 1987 and September 8, 2009 that were available in English, Swedish, or German. The authors used the following search strategy in PubMed: "Craniomandibular disorders/drug therapy [MeSH] OR Craniomandibular disorders/surgery [MeSH] OR Craniomandibular disorders/surgery AND "review" AND Meta-analysis [MeSH] AND systematic review." The search terms used in Cochrane Library included: "craniomandibular disorders" and "temporomandibular joint (TMJ)." The authors manually identified additional systematic reviews in the references of the original articles. <b>Selection Criteria:</b> Two authors independently selected "potentially eligible" articles then read them in full-text to verify that they met the inclusion and exclusion criteria. Disagreements were resolved via discussion between authors. <ul style="list-style-type: none"><li>• <b>Inclusion criteria:</b> (i) systematic reviews, (ii) concerned with TMD management</li><li>• <b>Exclusion criteria:</b> (i) duplicate publication, (ii) systematic review updated by same author in more recent publication, (iii) concerned with orthodontic treatment and development, (iv) systematic review of systematic reviews</li></ul> <b>Data Collection:</b> The authors collected the following data from eligible articles: study design, diagnosis, number of patients, types of intervention, outcome measures, results, quality score, authors conclusions. <b>Quality Assessment:</b> Two authors independently assessed the methodological quality of each eligible study using the assessment of multiple systematic reviews (AMSTAR) and level of research design (LRD) scoring. Disagreements were resolved via discussion.
<b>Setting</b> [e.g., locations such as hospital, community; rural; metropolitan; country]
Authors are faculty in the Department of Stomatognathic Physiology at Malmö University in Stockholm, Sweden.
<b>Participants</b> [N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up] Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. <ul style="list-style-type: none"><li>• This systematic review included a total of 30 articles- 23 qualitative systematic reviews and 7 meta-analyses.</li><li>• The authors divided the 30 articles into five treatment groups: occlusal appliances/adjustment (10), physical therapy (8), pharmacological treatment (7), TMJ and maxillofacial surgery (4), and behavioural and multimodal treatment (6).</li></ul>

- The strength of the primary studies varied between reviews: 18 articles were systematic reviews of randomized controlled trials (RCT), 3 articles reviewed case-control studies, and 9 reviewed a mix of RCTs and case-series.
- The most common diagnosis reported was “TMD,” though some reviews used more specific diagnoses (e.g. disc displacement, myofascial pain.)
- AMSTAR scores ranged from 2 to 11 with a median score of 6
- (N) studies were categorized into the following LRD categories: Level 1-2 (2); Level 1-3 (1); Level 2 (16); Level 2-3 (1); Level 3 (1); and Level 2-5 (9).

### Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

#### Control

- 30% of the systematic reviews included case-series (i.e. no control group)
- The authors reported the control group(s) for the remaining articles, which typically received ‘placebo’ or ‘no treatment.’
- Two PT intervention reviews’ control groups received an occlusal appliance or splint.
- One behavioural intervention review’s control group received “conventional treatment,” the details of which were not specified.

#### Experimental

The following interventions were included in (N) reviews for each treatment group:

- Occlusal appliances/adjustment: occlusal appliance (4), occlusal adjustment (3), repositioning splint (1), stabilization splint (2), intra-oral appliance (1), anterior positioning (1), and soft splints (1).
- Physical therapy: acupuncture (6), jaw exercises (3), manual therapy (2), electrophysical modalities (including TENS, laser, ultrasound) (3), postural correction (2), and relaxation training & education (1).
- Pharmacologic therapy: analgesics (2), antidepressants (3), benzodiazepines (3), botulinum toxin (3), and a few other drugs that appear more relevant to neurogenic facial pain.
- TMJ and Maxillofacial Surgery: arthroscopy (2), arthrocentesis (3), disc repair/repositioning (1), discectomy(1), and bilateral sagittal split (1).
- Behavioural and multimodal treatment: EMG Biofeedback (5), Cognitive Behavioural Therapy (CBT) (3), relaxation training (2), and education (1). One review included two experimental groups- simple and multimodal treatment. Most reviews in this category used primary studies that combined interventions (e.g. biofeedback + relaxation training.)

### Outcome Measures

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

Most of the included articles reported pain and clinical factors as their primary outcome measures:

- 29 reviews used pain intensity or pain reduction as their primary outcome measure.
- 25 reviews used a clinical outcome measure (e.g. jaw mobility, pressure pain threshold)

The following outcome measures were used in (N) reviews for each treatment category that is relevant to the clinical question:

- Physical therapy: pain intensity (7), clinical examination (6), daily activities (4), global improvement (4), pain pressure threshold (2), jaw mobility (2), self-reported symptoms (1), and pain reduction (1).
- Behavioural and multimodal treatment: pain intensity (4), pain reduction (2), depression (2), global improvement (1), daily activities (1), jaw mobility (1), sleep quality (1), Graded Chronic Pain Scale (1), and psychological status (1).

No specific outcome tools were reported. The authors note that many studies did not report data in a consistent or “transparent” manner.

### Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable. You may summarize results in a table but you must explain the results with some narrative.]

The authors were limited to qualitative findings due to the heterogeneity and variable methodology of the primary studies included in most systematic reviews. The findings for each treatment category that is relevant to the clinical question include:

- **Physical therapy-** (N) reviews report the following regarding acupuncture: (4) acupuncture has similar efficacy to conventional treatment; (3) acupuncture is better than no treatment; (1) acupuncture has a similar effect as placebo; and (2) no support for acupuncture. (N) reviews report the following in regards to other PT interventions: (3) jaw exercises are more effective than controls; and (2) postural training is more effective than no treatment. No reviews found support for the efficacy of electrophysical modalities to reduce TMD pain.
- **Behavioural and multimodal treatment-** All reviews in this treatment category found support for the efficacy of behavioural interventions for TMD management. (N) reviews report the following: (2) biofeedback combined with CBT or relaxation training is better than no treatment; (2) CBT and relaxation training have similar efficacy; (2) biofeedback is more effective than active control or no treatment; and (2) CBT is more effective conventional treatment. One review found no difference in the efficacy of simple and multimodal treatment for TMD patients with no psychological symptoms, but significantly increased efficacy of multimodal treatment (vs. simple) for TMD patients with major psychological symptoms.

### Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

There is modest evidence for the efficacy of occlusal appliances, acupuncture, behavioural therapy, jaw exercises, postural training, and some pharmacological treatments to manage TMD symptoms. Methodological variance between primary studies limits what conclusions can be drawn.

### Critical Appraisal

#### Validity

[Summarize the internal and external validity of the study. Highlight key strengths and weaknesses. Comment on the overall evidence quality provided by this study.]

**AMSTAR score:** 8/11; a priori design provided: yes; two independent data extractors: yes; comprehensive search: yes; status of publication: no; list of studies: yes; characteristics of studies: yes; quality assessment: yes; quality assessment used in conclusions: yes; appropriate methods to combine studies: N/A; publication bias assessed: no; conflict of interest stated; yes.

#### **Strengths:**

- **Selection bias:** The authors reduce the risk for selection bias by independently searching multiple databases. They include itemized citations for the articles they excluded.
- **Publication bias:** Articles in three languages (English, Swedish, and German) were included. Investigators manually searched references of each articles for additional reviews.
- **Quality assessment:** The authors clearly describe their quality assessment methods and instruments (i.e. AMSTAR, LRD.) Both authors individually reviewed each study and discussed rating discrepancies. Furthermore, they use their quality assessment to inform their own conclusions from each individual study. They briefly comment on each studies potential sources of bias, provide an in-depth analysis of the methodological quality across all studies, and offer suggestions to control bias in future research.

#### **Weaknesses:**

- **Selection criteria:** TMD diagnostic criteria are not defined in the search strategy or inclusion/exclusion criteria. This is reflected in the heterogeneity of subjects in the reviews they included (e.g. two studies on bruxism, which differs from TMD) and limits the external validity of their findings. The authors comment on the diagnostic inconsistency of the selected reviews, but not their own review.
- **Search strategy:** Their search terms were not specific to TMD (e.g. "orofacial pain") and did not include terms for all treatment categories included in the systematic review, which is a potential source of selection bias.
- **Publication bias:** No inclusion of grey literature or explanation for why it was omitted.
- **Quality of selected studies:** Overall, the selected reviews were of low to moderate quality. For instance, thirty percent of the studies included primary studies that lacked a control group and some had AMSTAR scores as low as 2. Though the authors discuss the general limitations of the reviews, they do not explicate how they weighed evidence from studies of differing methodological rigor.
- **Weak internal validity:** Many reviews, especially in the PT and behavioural categories, included primary studies that used various combinations of treatment (e.g. CBT + relaxation training.) This equivocates the results and limits our knowledge on the effect of individual interventions.

- **Weak external validity:** The generalizability of the findings is limited due to the heterogeneity of subjects across the primary studies, included reviews, and this review itself.

### Interpretation of Results

[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.]

This systematic review provides moderate evidence that jaw exercises, postural training, and behavioural interventions may be effective physical therapy interventions for managing TMD.

As the authors discuss, evidence from this systematic review is limited to qualitative conclusions due to methodological variance and weakness in the primary studies. Though AMSTAR indicates this review has a fairly low risk of bias, the clinical significance of their results is limited by ambiguous selection criteria that does not consider the source or chronicity of TMD pain, which may require different management.<sup>12</sup>

The large variance in outcome measures used across the primary studies limits our understanding of (i) the relative effect size of each intervention and (ii) which clinical measures they effect. It is worth noting that physical therapy reviews tended to use more clinical and functional measures (e.g. 4 PT reviews measured daily activity vs. 1 biobehavioral review), while biobehavioral reviews tended to use more assessments of psychological status (e.g. Graded Chronic Pain Scale, depression scale.) Thus, interventions in either category may have differing effects on various clinical measures.

Of particular interest, one systematic review of 11 RCTs found that multimodal interventions (vs. 'simple' interventions) were more effective at managing chronic TMD patients with major psychological symptoms. Both interventions had similar effects for patients without psychological symptoms.<sup>13</sup> Upon closer review, a combination of pain education and PT home exercises was the most effective 'multimodal' intervention.<sup>13</sup> While this review was of limited quality (AMSTAR=4), the results have implications for the clinical question— (i) they highlight the value of using a psycho-behavioural assessment for patients with chronic symptoms and, (ii) suggest that the patient in question may benefit from a multimodal intervention. Additional research with improved methodology is needed to elucidate appropriate strategies to individualizing treatment.

### Applicability of Study Results

[Describe the relevance and applicability of the study to your clinical question and scenario. Consider the practicality and feasibility of the intervention in your discussion of the evidence applicability.]

**Relevance & Applicability:** The evidence from this systematic review has limited relevance and applicability to the patient in question.

- The authors' PubMed search terms were biased toward surgical and pharmacological interventions, which may explain the limited number of PT and behavioural articles included in this review.
- The PT treatment category included 6 reviews of acupuncture, which does not fall in the scope of PT practice in the U.S. (Note: the authors are Swedish.) Ultimately, only 4 reviews that included 26 RCTs included interventions in the scope of PT practice in the U.S. The lack of evidence for PT interventions limits the relevance of results in this category.
- Some of the reviewed behavioural interventions fall under the scope of PT practice including EMG biofeedback, relaxation training, pain education, and home exercise. CBT does not fall under the scope of PT, but one review showed it had a similar effect to relaxation training (on ambiguous outcomes.) Still, CBT could be a valuable referral for the patient in question.
- As previously discussed, one review compared simple vs. multimodal treatment. However, a closer review of this article revealed that most comparisons were made between standard dental management and another intervention, which is not applicable to the clinical question.<sup>13</sup> Still, the results suggest that some sort of multimodal approach is useful for the patient in question, due to the chronicity symptoms.
- Lastly, the heterogeneity of subjects across these studies limits the applicability of evidence to the patient in question. The authors do not provide demographic characteristics, explicit diagnostic criteria, or chronicity of symptoms for the subjects included in each review.

**Practicality & Feasibility:** The limited evidence from this systematic review is practical and feasible to use when treating the patient in question.

- The physical therapy and biobehavioral intervention recommendations are generally safe to use with patients. PTs are highly trained in postural correction and prescribing appropriate exercises. PTs may require additional training and education to provide appropriate relaxation training and EMG biofeedback for craniofacial muscles, but these interventions are unlikely to cause harm even when performed inaccurately.
- The feasibility of EMG biofeedback is limited by the cost and availability of equipment. However, relaxation training, postural correction, and jaw exercises are feasible in any setting and do not necessarily require any equipment.

- The results of the multimodal review suggest the potential usefulness of a psychological screening tool or assessment for patients with chronic TMD (i.e. Graded Chronic Pain Scale.) Incorporating this type of self-report screening tool is practical, feasible, and has no risk of harming the patient. Though evidence is limited in this population, this type of screening tool has the potential to provide valuable information regarding the patients perspective that can inform interventions and progression of treatment.

**(2) Description and appraisal of "A Systematic Review of the Effectiveness of Exercise, Manual Therapy, Electrotherapy, Relaxation Training, and Biofeedback on the Management of Temporomandibular Disorder" by Medicott et al. 2006.<sup>8</sup>**

**Aim/Objective of the Study/Systematic Review:**

The aim of this systematic review is to evaluate the efficacy of various physical therapy interventions for management of acute and chronic TMD.

**Study Design**

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.

Medicott et al. is a systematic review of randomized controlled trials (RCTs) and non-randomized controlled trials on the management of acute and chronic TMD.

**Search Strategy:** A literature search was performed in the following databases: Index Medicus (MEDLINE), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the Cochrane Central Register of Controlled Trials. The search was limited to articles published between January 1966 and January 2005 that were published in English. The following search terms were used: "facial pain," "physical therapy," "rehabilitation," "temporomandibular disorder (TMD)," "temporomandibular joint (TMJ)," "temporomandibular joint syndrome," and "therapy."

**Selection Criteria:** One author performed the literature search and study selection based on the following criteria:

- **Inclusion criteria:** (i) subjects fit into one of three categories on the first axis of Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)\*, (ii) intervention was in scope of PT practice, (iii) experimental design, (iv) outcomes measures include pain, ROM, disability, or function.
- **Exclusion criteria:** (i) post-surgical interventions, (ii) combination of PT and non-PT interventions, (iii) acupuncture, (iv) passive ROM device interventions

**Data Collection:** One author collected the following data from eligible articles: study design, number of subjects, mean age of subjects, sex of subjects, types of intervention, outcome measures, results, and follow-up results. The same author grouped subjects of each study into a category on the first axis of the RDC/TMD and calculated effect size when standard deviations and means were available.

**Quality Assessment:** Two authors evaluated the quality of the eligible studies by categorizing them according to Sackett's Levels of Evidence and evaluating them using the following criteria "adapted" from Megens and Harris and the McMaster Occupational Therapy Evidence-Based Practice Research Group: (i) randomization, (ii) inclusion/exclusion criteria, (iii) baseline similarity of groups, (iv) description of treatment protocol, (v) investigate outcome measure reliability, (vi) investigate outcome measure validity, (vii) blinding of subject, investigator, & assessor, (viii) report dropouts, (ix) long-term (>6mo) follow-up, (x) investigate home program adherence. The authors consider a score of 8-10 to be "strong methodological rigor" and a score of 5 or less to be "weak." (Note: no information is provided regarding who created this tool or how/why the criteria was adapted.) Four randomly selected studies were evaluated by both authors in order to assess their inter-rater reliability.

\*The first axis is comprised of three common categories of TMD: (i) muscle disorders, including myofascial pain, (ii) disc displacement, and (iii) arthritis, arthralgia, and arthrosis.

**Setting**

[e.g., locations such as hospital, community; rural; metropolitan; country]

The primary authors are physical therapists affiliated with Lion's Gate Hospital and the School of Rehabilitation Sciences at the University of British Columbia in Vancouver, BC.

### Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

- This systematic review included a total of 30 articles- 22 RCTs, 4 single group pretest-posttest design with a nontreatment control period, 2 case-series design, 1 single-group randomized cross-over design, and 1 experimental design with randomized order of treatments within sessions.
- Using Sackett's Levels of Evidence, the authors classified all 22 RCTs as "Level 2b" due to poor methodological quality. The remaining 8 studies were classified as "Level 4" due to a lack of control group.
- Using their adapted criteria for methodological rigor, zero studies were classified as "strong," 5 studies were "moderate," and 25 were considered "weak."
- The authors divided the 30 articles into 4 treatment groups: exercise or manual therapy (15), electrotherapy (8), relaxation training or biofeedback (8). (Note: one study that compared exercise and biofeedback was categorized twice.)
- The authors categorized the 30 articles into subgroups outlined on the RDC/TMD: myofascial TMD (17), disc displacement (6), and arthritis (6). One study's subjects were 50% myofascial TMD and 50% arthritis.
- Of the 23 studies that reported inclusion criteria. 5 required chronic TMD symptoms (6 months or greater.)
- Inter-rater agreement for the four independently reviewed studies was 100% for Sackett's Levels of evidence and 73.5% for the adapted criteria for methodological rigor.

### Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

#### *Control*

- 8 out of 30 studies did not include a control group.
- In the tables, the authors briefly describe the control groups for some of the remaining 22 studies. Control groups typically received either no treatment or a placebo.

#### *Experimental*

The following interventions were included in (N) reviews for each treatment group:

- Exercise and Manual Therapy: active exercises (8), manual mobilizations (8), postural correction(5), stretches (3), and coordination exercises (1). Most studies in this category used combined treatment modes (e.g. active exercises + manual mobilization + postural correction) and sometimes added modalities (e.g. moist heat, occlusal night splint) and/or relaxation training. 11 of 15 studies included a home program.
- Electrotherapy: TENS (2), ultrasound (2), mid-laser (2), pulsed radio frequency energy (PRFE) (1), low-level laser (1), microcurrent electrical neuromuscular stimulation (1), short-wave diathermy (1), and mega-pulse (1). Parameters varied considerably between studies.
- Biofeedback and Relaxation Training: EMG biofeedback (6), breathing and postural relaxation techniques (1), muscle relaxation training (1), proprioceptive re-education (1), relaxation tape (1), stress management education (1). 6 of 8 studies compared one or more of these interventions with use of an occlusal night splint.

### Outcome Measures

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

- Over 75 different outcome measures were used across the 30 studies.
- The most common primary outcomes of interest were self-reported pain, pain on palpation, active ROM, EMG activity, self-reported outcome tools for symptom severity & frequency, impairment and dysfunction indexes, psychological status scales. Specific outcome tools are not reported here due to the large variation in tools and methods used to assess similar outcomes of interest, and are available in the tables of Medicott et al.

## Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable. Use a table to summarize results if possible.]

The authors were limited to qualitative findings due to the heterogeneity and variable methodology of the primary studies included in most systematic reviews.\* The authors endorse the following recommendations, which were derived from the 30 selected studies:

- Active exercises and manual therapy, alone or combined, may be effective at increasing jaw AROM in TMD resulting from acute or chronic myofascial pain, disc displacement, or arthritis. (Home exercise programs were typically included in these treatment protocols.)
- The independent effects of postural training are unclear, but it may be useful for increasing jaw AROM and decreasing pain when combined with other interventions and home exercise programs.
- When compared to other electrophysical interventions, mid-laser therapy may be more effective at decreasing pain & increasing ROM in patients with acute disc displacement.
- In patients with acute or chronic myofascial TMD, biofeedback, relaxation training, and proprioceptive re-education may be more effective at decreasing pain and increasing ROM when compared to placebo or occlusal splints.
- Multimodal interventions that include active exercise, postural correction, manual therapy, and relaxation training may be effective at decreasing pain & impairment and increasing ROM in the short-term. The authors note that they cannot discern the effects of a combination program from the effects of an individual technique with the available data.

*\*Note: the authors do not explicitly discuss why they were unable to perform a meta-analysis, though this can be inferred from their discussion of the heterogeneity of data. One author calculated the effect size for each outcome of each study (available in tables), but this data was not pooled or expounded on in the narrative results or discussion.*

## Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

There is some evidence for the efficacy of for some combination of the following interventions for management of TMD: active exercise, manual therapy, postural training, mid-laser therapy, relaxation training, biofeedback, and proprioceptive re-education. Additional research with standardized diagnostic criteria and outcome measures is needed to elucidate the relative effects of each intervention and combination of interventions for different categories of TMD.

## Critical Appraisal

### Validity

[Summarize the internal and external validity of the study. Highlight key strengths and weaknesses. Comment on the overall evidence quality provided by this study.]

**AMSTAR score:** 4/11; a priori design provided: yes; two independent data extractors: no; comprehensive search: no; status of publication: no; list of studies: yes; characteristics of studies: yes; quality assessment: yes; quality assessment used in conclusions: yes; appropriate methods to combine studies: N/A; publication bias assessed: no; conflict of interest stated: no.

### Strengths:

- **Selection Criteria:** The authors used the RDC/TMD diagnostic criteria for their inclusion criteria, data collection, and to inform their analysis. This increases the external validity of the results by clarifying which results can be generalized to which sub-populations of TMD. Still, heterogeneity of inclusion criteria across the selected studies limits the generalizability but this is appropriately discussed.
- **Discussion of Results:** The authors specify which outcomes were affected by the recommended interventions and combinations of interventions, which improves the internal validity of the results. This helps distinguish which interventions may be most useful for patients with a particular limitation or complaint (e.g. jaw ROM vs. pain.)
- **Discussion of limitations:** The authors acknowledge some of the limitations of their methodology including the risk for publication bias, selection bias, and evaluation bias.

### Weaknesses:

- **Search strategy:** The authors included articles from as early as 1966, which may include interventions and protocols that do not reflect current patient management.<sup>11</sup>

- **Selection Bias:** Only one author performed the literature search and selection of studies. The author did not cite the articles that they ultimately excluded.
- **Publication Bias:** The author did not include any supplementary search strategy and only included English-language articles. It is possible that this review does not fully represent the available literature.
- **Quality assessment:** The methodological rigor of most studies was assessed by just one author who used apparently new, adapted criteria from Megens and Harris and the McMaster OT EBP group. It is unclear who adapted these criteria, why the criteria were adapted, and how they were adapted. Thus, this quality assessment tool seems arbitrary and has no validity or reliability data apart from the inter-rater reliability calculated from two authors ratings of just four randomly selected studies. There is no explanation for their cut-offs for categorization of studies as having strong, moderate, or weak methodological rigor. Overall, this tool and the methods used to assess the quality of research seem inappropriate.
- **Quality of selected studies:** Though the quality assessment is limited, it is still apparent that the quality of the selected studies is low. All 22 RCTs were downgraded due to poor methodology and the 8 remaining studies did not include a control group.
- **Presentation of data:** The tables of data for individual studies are poorly organized and lack transparency. The authors only report the results in terms of the effect sizes that they calculated for each outcome measure in a manner that is hard to interpret and appears inconsistent. The inclusion of effect size seems arbitrary due to the large variance of outcome measures used and subsequent inability to pool the data or make genuine comparisons across studies. To add to the ambiguity of the presented data, the authors neglect to include the original conclusions or their own conclusions for the individual studies. Additionally, they don't include citations to any individual study in their recommendations or discussion which greatly reduces the transparency of this systematic review.

### Interpretation of Results

[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.]

This systematic review provides very limited evidence for the efficacy of some combination of manual therapy, exercise, postural correction, EMG biofeedback, pain education and/or relaxation training for improving the clinical outcomes of patients with various TMD diagnoses.

Overall, the evidence that can be drawn from this systematic review is very limited due to the lack of transparency in the presentation & discussion of data and, the use of a questionable risk of bias assessment tool, and the generally poor rigor of the methodology used in the selected studies. Due to heterogeneity of the data, only qualitative conclusions can be drawn.

Furthermore, the clinical question cannot be explicitly answered by the results of this study since there is no evidence for the relative effectiveness of PT interventions with and without the inclusion of a psychological intervention (e.g. relaxation training.) Though a handful of the selected studies combine PT and psycho-behaviour interventions, the large variance in outcome measures used between studies limits what between-study comparisons can be drawn using effect sizes. Between-study variance in intervention combinations and treatment protocols obscures the relative effects of any individual intervention, let alone combinations of interventions.

Though no conclusions can be drawn about the efficacy of any individual technique or combination of techniques, the results of these studies suggest that a multimodal intervention that includes a combination of traditional physical therapy and psychological interventions may be effective at managing a variety of TMD diagnoses. The results also highlight a need for future research that investigates the efficacy of individual interventions using standardized protocols.

### Applicability of Study Results

[Describe the relevance and applicability of the study to your clinical question and scenario. Consider the practicality and feasibility of the intervention in your discussion of the evidence applicability.]

**Relevance & Applicability:** The results of this systematic review are relevant and applicable to the clinical question.

- This review exclusively assessed PT interventions related to the management of acute and chronic TMD on the clinical outcomes outlined in this CAT's inclusion criteria (i.e. pain, ROM, & function.) However, only 5 selected studies required that subjects have chronic duration of TMD (>6 months) and 7 did not report inclusion criteria at all. Thus, this systematic review's relevance is limited by the quality of the selected studies.
- The authors use of the first axis RDC/TMD criteria to include and categorize individual studies clarifies which results apply to the patient in question, who presents with signs of both myofascial TMD and disc displacement, which can mimic each other and/or occur together.<sup>12</sup>
- The author's search strategy included PT-specific terms like "rehabilitation" and "therapy." Their selection criteria limited the review to studies that included only physical therapy interventions. While

this applicable to the clinical question, the exclusion of psychologist-administered interventions (e.g. CBT) limits our knowledge on the efficacy of making a referral for the patient in question.

### **Practicality & Feasibility:**

- All of the interventions discussed fall under the scope of PT practice and may be administered by trained physical therapists. The ability to administer EMG biofeedback and electrophysical modalities may be limited by the cost and availability of equipment.
- The relative risk of beneficial and adverse effects of any intervention discussed in this study is unclear. However, PTs are trained in the appropriate use of all interventions and modalities discussed and, ideally, can minimize the risks of injury using their clinical judgment.
- 23 of 30 studies reported their protocols in sufficient detail to replicate. However, no two studies used an identical protocol so PTs cannot necessarily confidently choose the best protocol for a particular patient using the results of this review. Furthermore, some of these studies are many decades old and may use outdated practice techniques.
- The large variety of outcome measures used gives little insight into which assessment tools may be most-appropriate to use in the clinic when managing TMD patients.

## **SYNTHESIS AND CLINICAL IMPLICATIONS**

[Synthesize the results, quality/validity, and applicability of the two studies reviewed for the CAT. Future implications for research should be addressed briefly. Limit: 1 page.]

**Synthesis of Evidence:** The results of these two systematic reviews suggest that it's reasonable to hypothesize that a multimodal physical therapy treatment that includes a psychological intervention may be more useful to a patient suffering from chronic TMD than traditional therapy treatments alone. However, neither offers any strong evidence that supports or refutes this hypothesis. While both reviews found some evidence to support various interventions that are relevant to the clinical question, no primary study directly addressed the clinical question by comparing the efficacy of the treatment strategies in question.

Overall, the evidence base for physical therapy and psychological interventions for management of TMD is limited in quantity and quality. However, the limited evidence available suggests that a 23-year old female with chronic TMD may benefit from some combination of traditional physical therapy and/or psycho-behavioural interventions including active jaw exercises, manual therapy, postural training, EMG biofeedback, relaxation techniques, and behavioural interventions. Additional evidence with standardized methods and higher methodological rigor is needed to elucidate the relative efficacy of individual treatments and combinations of treatments for the management of chronic TMD.

**Implications for clinical practice:** Though the evidence-base is limited, it signifies the potential usefulness of many interventions that fall under the scope of PT practice, both traditional and psychosocial in nature. PTs are highly-trained in exercise prescription, manual therapy, and postural correction and, ideally, should be able to minimize the risk and maximize the benefits of these treatments for patients using their clinical expertise. While PTs may require additional training and education to properly administer EMG biofeedback, pain science education, relaxation training to TMD patients, these are fairly low-risk interventions that are appropriate and feasible for clinical PT practice.

There is evidence to support the usefulness of a psychological and/or behavioural assessment when evaluating and managing patients with chronic TMD pain.<sup>5,8,13</sup> This evidence is consistent with a growing body of widely-accepted evidence of the role of psycho-behavioural variables in modulating treatment outcomes for patients in chronic pain.<sup>1,2,13,14</sup> A self-report outcome tool, such as the Graded Chronic Pain Scale, is practical and feasible for clinical use and has the potential to reveal valuable insight into the patients perception of their condition that can be used to inform treatment.<sup>5,13</sup>

Lastly, given the evidence for the efficacy of CBT and dental interventions for managing TMD, it may be prudent for PTs who are treating this population to foster good relationships with psychologists and dentists.<sup>5,12</sup> These clinicians may serve as valuable referral sources and also be appropriate to refer patients to, especially if evidence suggests they would benefit from multidisciplinary treatment (e.g. chronic pain.<sup>5,12,13</sup>)

**Implications for future research:** It is important that future research improves the standardization of TMD diagnostic criteria (i.e. the RDC/TMD criteria) in order to improve the clarity and external validity of the evidence to different patient sub-populations.<sup>8</sup> Additionally, these studies should clearly report their treatment protocols and use standardized outcome measures in order to allow meaningful, quantitative comparisons between studies. These methodological strategies will help minimize heterogeneity of data and allow the meta-analyses of various interventions to create a stronger evidence base.

Especially in regards to chronic TMD research, research should include standardized outcome measures in multiple domains including clinical measures, functional outcomes, and psychological variables. This may elucidate the role of psychological interventions in treating this patient sub-population.

It's worthy to note that the evidence for exercise and manual therapy PT interventions is much stronger than the evidence for electrophysical and other modalities.<sup>5,8</sup> Perhaps this is related to the relatively better efficacy of "active" versus "passive" treatments for pain management.<sup>14</sup> Research suggests that "active" treatments, where the patient is a participant, are more effective at pain management than "passive" treatments.<sup>14</sup> This would be an interesting area for future research to explore that may give insight to treatment strategies for TMD management.

## REFERENCES

[List all references cited in the CAT]

1. Edwards RR, Dworkin RH, Sullivan MD, Turk DC, Wasan AD. The role of psychosocial processes in the development and maintenance of chronic pain. *J. Pain* 2016;17(9 Suppl):T70-92. doi:10.1016/j.jpain.2016.01.001.
2. Lotze M, Moseley GL. Theoretical considerations for chronic pain rehabilitation. *Phys. Ther.* 2015;95(9):1316-1320. doi:10.2522/ptj.20140581.
3. de Freitas RFCP, Ferreira MÂF, Barbosa GAS, Calderon PS. Counselling and self-management therapies for temporomandibular disorders: a systematic review. *J. Oral Rehabil.* 2013;40(11):864-874. doi:10.1111/joor.12098.
4. Friction JR, Ouyang W, Nixdorf DR, Schiffman EL, Velly AM, Look JO. Critical appraisal of methods used in randomized controlled trials of treatments for temporomandibular disorders. *J Orofac Pain* 2010;24(2):139-151.
5. List T, Axelsson S. Management of TMD: evidence from systematic reviews and meta-analyses. *J. Oral Rehabil.* 2010;37(6):430-451. doi:10.1111/j.1365-2842.2010.02089.x.
6. Litt MD, Shafer DM, Kreutzer DL. Brief cognitive-behavioral treatment for TMD pain: long-term outcomes and moderators of treatment. *Pain* 2010;151(1):110-116. doi:10.1016/j.pain.2010.06.030.
7. Turner JA, Mancl L, Aaron LA. Short- and long-term efficacy of brief cognitive-behavioral therapy for patients with chronic temporomandibular disorder pain: a randomized, controlled trial. *Pain* 2006;121(3):181-194. doi:10.1016/j.pain.2005.11.017.
8. Medlicott MS, Harris SR. A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. *Phys. Ther.* 2006;86(7):955-973.
9. Jochum H, Baumgartner-Gruber A, Brand S, Zeilhofer HF, Keel P, Leiggener CS. [Chronic myofascial pain. Reduced pain through psychoeducation and physiotherapy]. *Schmerz* 2015;29(3):285-292. doi:10.1007/s00482-015-0005-5.
10. Buescher JJ. Temporomandibular joint disorders. *Am. Fam. Physician* 2007;76(10):1477-1482.
11. Jewell DV. *Guide to Evidence-Based Physical Therapist Practice*. Third edition. Burlington, MA: Jones & Bartlett Learning
12. Herb K, Cho S, Stiles MA. Temporomandibular joint pain and dysfunction. *Curr Pain Headache Rep* 2006;10(6):408-414.
13. Türp JC, Jokstad A, Motschall E, Schindler HJ, Windecker-Gétaz I, Ettl DA. Is there a superiority of multimodal as opposed to simple therapy in patients with temporomandibular disorders? A qualitative systematic review of the literature. *Clin. Oral Implants Res.* 2007;18 Suppl 3:138-150. doi:10.1111/j.1600-0501.2007.01480.x.
14. Cosio D, Lin E. Role of active versus passive complementary and integrative health approaches in pain management. *Glob. Adv. Health Med.* 2018;7:2164956118768492. doi:10.1177/2164956118768492.