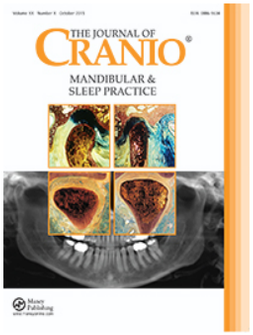

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LITERATURE REVIEW

Oral myofunctional therapy for the treatment of temporomandibular disorders: A systematic review

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ABSTRACT

Objective: To investigate the role of oral myofunctional therapy for the treatment of temporomandibular disorders.

Methods: A search of the literature was carried out looking for randomized controlled trials performed on humans and written in English, Italian, French, and Arabic.

Results: Four randomized controlled trials were found and evaluated by using the Study Quality Assessment Tool of the National Institute for Health and Clinical Excellence.

Oral myofunctional therapy was shown to be effective for the treatment of temporomandibular disorders, alone or associated with other treatments, in three out of four studies, with significant reduction of pain intensity when compared to other conservative treatments and no treatment.

Discussion: Even though scientific evidence is weak, oral myofunctional therapy appears to be effective for the treatment of temporomandibular disorders with favorable cost-benefit and risk-benefit ratios.

KEYWORDS

Oral myofunctional therapy; exercise therapy; physical therapy; temporomandibular disorders; systematic review

Introduction

Temporomandibular disorders (TMD) encompass a group of musculoskeletal and neuromuscular conditions that involve the temporomandibular joints (TMJs), the masticatory muscles, and all associated tissues. TMD have been identified as a major cause of non-dental pain in the orofacial region, with 40 to 75% of the adult population reporting at least one sign and 33% complaining of at least one symptom of TMD [1,2].

First choice management of such disorders is based on reversible and conservative treatments, such as self-management, behavioral modifications, physical therapy, medications, and orthopedic appliances [1]. Irreversible therapies, such as occlusal therapy or surgery should be carefully evaluated and limited to selected cases [1].

Some of the most common physical therapy modalities are exercises. Different types of exercises have been proposed for the treatment of TMD [3–5]; however, a specific type of therapy aimed to rehabilitate the stomatognathic function, termed oral myofunctional therapy (OMT), which is mostly based on oral exercises, has been suggested [6–8]. The reason for this is that pain and discomfort during physiological activities like swallowing, talking, chewing, characterizing a secondary orofacial myofunctional disorder, are frequently reported by TMD patients [7,9,10]. OMT includes exercises to enhance the precision and coordination of isolated movements of the orofacial structures, such as jaw, tongue, lips, and cheeks, with the goal of balancing the function of the stomatognathic system [7]. In addition, OMT specialists are trained to promote functional tongue posture (in absence of mechanical restriction due to a tight lingual frenum), nasal breathing (in the absence of mechanical obstruction), lip seal, and proper mastication [11]. De Felicio et al. [12–14] also proposed a protocol for the evaluation of the different aspects of orofacial myofunctional disorders (appearance and posture, mobility, functions, functional occlusion, mandibular movements) with scores, both for children and adults. This allows grading of specific orofacial myofunctional disorders within the limits of the selected items.

The aim of the present study was to conduct a systematic review of randomized controlled studies (RCTs) to evaluate the efficacy of OMT for the treatment of TMD.

Materials and methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was followed while

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writing the review and was adapted according to the journal's guidelines [15].

Literature search

A systematic review of the literature was performed looking for all articles published on the use of OMT for the treatment of temporomandibular disorders.

Inclusion criteria included RCTs on the use of OMT, alone or in association with other treatment modalities, compared to placebo or compared to other treatments, for the management of temporomandibular disorders and masticatory myofascial pain.

Exclusion criteria were review articles, case control and case series studies, non-randomized controlled studies, and studies describing treatment exercises different from the ones included in OMT protocols.

On the 23rd of April 2019, the literature search was performed using the following keywords: "temporomandibular disorders, temporomandibular joint disorders, craniomandibular disorders, myofascial pain, myofascial pain dysfunction syndrome, facial pain, TMD, TMJ, CMD" (for the identification of the pathology), combined with the following keywords: "oral myofunctional therapy, orofacial myofacial therapy, OMT, myofunctional therapy, myofunctional exercises, tongue exercises, orofacial exercises, lip exercises, jaw exercises, and speech therapy" (for the identification of the therapy). The following databases were searched: PubMed, Ovid Medline, Scopus, Google Scholar, and The Cochrane Central Register of Controlled Trials (CENTRAL). The PRISMA flow diagram of the systematic literature search is displayed in Figure 1. Two authors (M. M. and M. DG.) independently screened the titles and the abstracts of the articles for relevance. In case of disagreement, a decision was made after a consensus was reached, and in case of indecision on the inclusion of a study in the review, help from an oral myofunctional therapist (Dr. V. F.), was requested. The register of clinical trials (ClinicalTrials.gov) of the U. S. National Library of Medicine, the International Clinical Trials Registry Platform of the World Health Organization, the Health Canada's Clinical Trials Database, and the EU Clinical Trials Register were also searched. Hand search of the cited references of the selected articles was also performed to look for additional studies.

Assessment of the studies

Evaluation of the studies included in this review was performed to assess the risk of bias in each study by using the Study Quality Assessment Tool of the National Institute for Health and Clinical Excellence, specifically, by using the Quality Assessment of Controlled Intervention Studies [16]. This consists of 14 criteria that need to be verified, to evaluate randomization (1–3), blinding (4,5), baseline characteristics (6), drop-outs (7,8), adherence to the intervention (9), other interventions (10), outcome assessment (11,13), sample size (12), and intention-to-treat analysis (14). Each criterion is assessed with one of the following answers: yes, no, cannot determine (CD), not reported (NR), or not applicable (NA). Assessment was carried out by two authors independently (M. M. And M. DG.), and in case of disagreement, the final decision was made after a consensus was reached. When consensus was not reached, the third Author (K. Z.) was consulted, and the decision was taken by the majority [16].

Results

All details of the systematic literature search and the results are displayed in Figure 1. The final selection included only 4 articles [17–20].

The four articles were assessed for the risk of bias by using the Study Quality Assessment Tool of the National Institute for Health and Clinical Excellence, specifically, the Quality Assessment of Controlled Intervention Studies was used [16]. All four studies were considered and described as RCTs, although only two described the method of randomization and none reported the concealment of the treatment allocation. They were not double-blind studies, probably because the type of treatment, based on exercises, did not allow blinding of the clinicians. However, in two studies, the subject assessing the outcomes was blinded to the participants' group assignments. Baseline characteristics of the patients were similar in the groups except for one study, and the differential drop-out rate was similar in the groups, except for one study. One of the authors described the sample size calculation and the power analysis of the study in relation to the number of subjects enrolled. The absence of blinding procedures, both for patients and clinicians involved in the treatment, and the lack of sample size calculation, in addition to other possible bias due to non-reported method of randomization (except for one study) and concealment of treatment allocation makes three studies likely to be subjected to a high risk of bias. A better blinding procedure and calculation of sample size made the article by Mulet et al. [17] likely to be subjected to a low risk of bias. Details of the assessment of the risk of bias for each study are shown in Table 1.

Since the outcome of the studies was evaluated differently in the trials, a meta-analysis of the results could not be performed.

The first study by Mulet et al. [17], published in 2007, is an RCT evaluating the efficacy of a series of

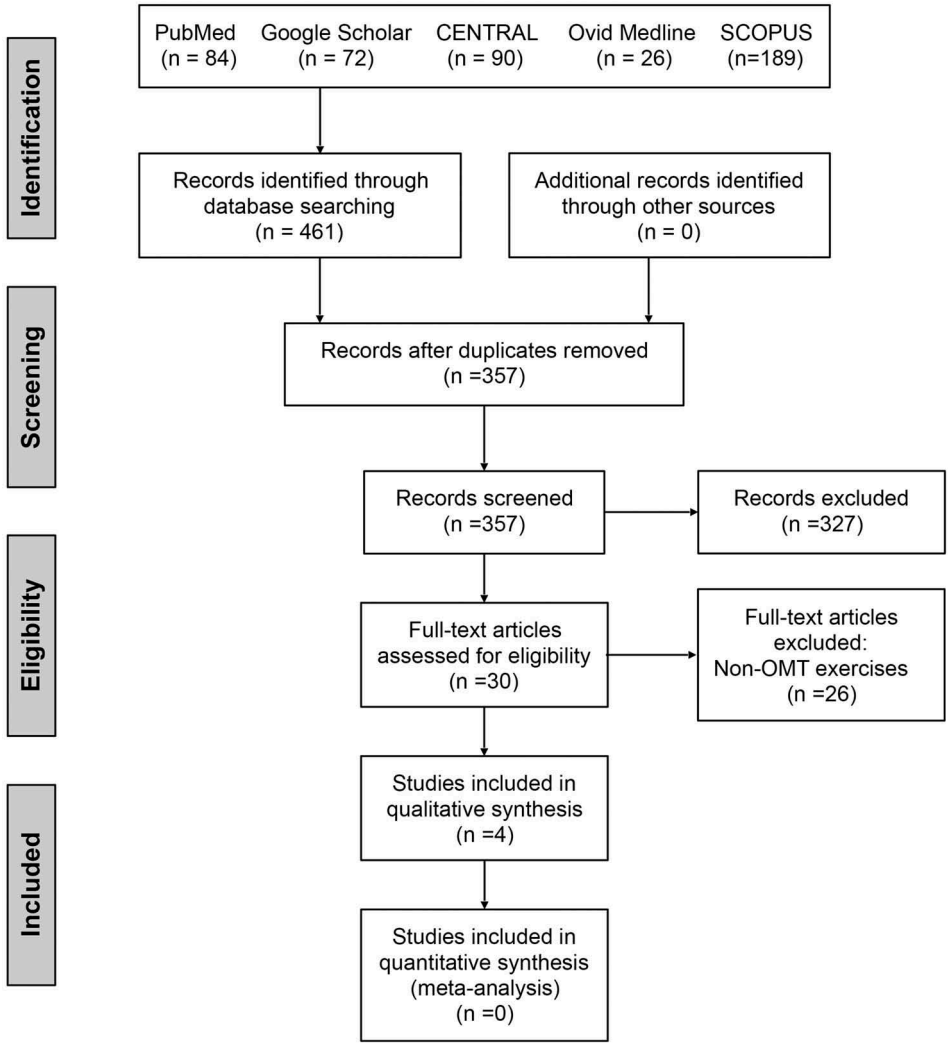

Figure 1. PRISMA flow diagram (Preferred reporting items for systematic reviews and meta-analysis). OMT: Oral myofunctional therapy.

exercises for the tongue, neck, shoulders, and jaw, in addition to a self-care program, compared to the self-care program alone, in 45 patients with myofascial pain. Specifically, the exercises were the following: 1) Learn the rest position of the tongue, with the front third of the tongue against the palate with slight pressure, and breathe through the nose using the diaphragm for breathing; 2) Correct abnormal scapular protraction through shoulder girdle retraction; 3) Clasp the hands firmly behind the neck and nod the head forward to elongate the posterior cervical muscles by distraction of the upper cervical spine and alleviate mechanical compressions; 4) Nod the head and glide the neck backward, stretching the head forward to distract the cervical vertebrae; 5) Control TMJ rotation by opening and closing the mouth with the tongue against the palate; 6) Induce masticatory muscle relaxation through the principle of reciprocal inhibition by grasping the chin with the fingers and moving the mandible up, down, and sideways, applying gentle resistance.

Forty-two patients completed the study. No placebo was used. Masticatory muscle and cervical pain were assessed by a numeric graphic rating scale (NGRS) on a 10 cm line, with 0 indicating "no pain," and 10 indicating "the worst pain imaginable," and a verbal rating scale (VRS), with the categories of no pain, mild, moderate, severe, and very severe pain. Head posture in the sagittal plane was evaluated by measuring the horizontal distance of the tragus of the ear to the acromion of the shoulder, neck inclination, and cranial rotation. Each subject was evaluated at baseline, 1-week, and 4-week follow-ups. The results show a statistically and clinically significant decrease of pain symptoms, with no difference between the groups, and a clinically non-significant change in head posture.

Table 1. Assessment of the risk of bias for each study.

	Criteria	Mulet [17]	De Felicio [18] 2008	De Felicio [19] 2010	Machado [20]
1	Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	Y	Y	Y	Y
2	Was the method of randomization adequate (i.e., use of randomly generated assignment)?	Y	NR	NR	Y
3	Was the treatment allocation concealed (so that assignments could not be predicted)?	NR	NR	NR	NR
4	Were study participants and providers blinded to treatment group assignment?	N	N	N	N
5	Were the people assessing the outcomes blinded to the participants' group assignments?	Y	N	NR	Y
6	Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?	Y	Y	N	Y
7	Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	Y	Y	Y	Y
8	Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	Y	Y	Y	N
9	Was there high adherence to the intervention protocols for each treatment group?	Y	Y	Y	Y
10	Were other interventions avoided or similar in the groups (e.g., similar background treatments)?	Y	Y	Y	Y
11	Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	Y	Y	Y	Y
12	Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	Y	N	N	N
13	Were outcomes reported or subgroups analyzed pre-specified (i.e., identified before analyses were conducted)?	Y	Y	Y	N
14	Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	Y	Y	Y	Y

Y: yes; N: no; CD: cannot determine; NA: not applicable; NR: not reported.

A second study by de Felicio et al. [18], published in 2008, is an RCT evaluating the efficacy of OMT in a group of 10 articular TMD patients with otologic symptoms. A second group with 10 articular TMD patients and a third group of 8 asymptomatic subjects were used as controls. Specific OMT exercises were not described; however, they were aimed to favor increase of blood circulation and pain relief, mandibular posture and mobility without deviations, coordination of the muscles of the stomatognathic system, and equilibration of the stomatognathic functions compatibly with dental occlusion. No placebo was used. Subjects were assessed by clinical evaluation and EMG analysis at the time of diagnosis, and then at the end of the treatment, which consisted of 9 to 13 sessions of OMT (mean follow-up duration 135 days).

In the diagnostic phase, a correlation was found between otologic symptoms and TMD symptoms. Furthermore, the study group only showed a significant decrease of both otologic and orofacial symptoms, tenderness to palpation of the masticatory muscles and the TMJs, and of the asymmetric index between the muscles (evaluated by surface electromyography [EMG]). Neither of the control groups showed any significant changes of the outcome measures, except for the worsening of right TMJ pain on palpation in one patient with TMD.

A third study by de Felicio et al. [19], published in 2010, is an RCT evaluating the efficacy of OMT in a group of patients with articular and muscular TMD, compared to the use of a stabilization appliance (Michigan splint) and two symptomatic and asymptomatic control groups. A total of 40 patients were evaluated: 10 patients were treated with OMT, 10 patients were treated with a stabilization appliance, 10 patients were included in the symptomatic control group, and 10 subjects were included in the asymptomatic control group. The OMT exercises were not listed; however, the aim of such treatment was described as the same as the previous study [19]. No placebo was used. All subjects were assessed by clinical evaluation to determine the Helkimo's indices Di and Ai, the frequency and severity of TMD signs and symptoms, and orofacial myofunctional disorders, both at the time of diagnosis and after four months. The results show a decrease of all outcome measures for both treatments, while the symptomatic and asymptomatic control groups did not show any significant changes. However, patients treated with OMT presented better results and differed significantly from the patients treated with a stabilization appliance regarding the number of subjects classified as AiII, the severity of TMJ and muscle pain, the frequency of headache, and stomatognathic functions.

A fourth study was published by Machado et al., in 2016 [20]. It is an RCT evaluating the efficacy of different therapies in 102 patients with chronic TMD. In the first group (21 subjects), low level laser therapy (LLLT) was associated with oral myofunctional exercises (OME); the second group (22 subjects) was treated with OMT (which includes OME and pain relief strategies); in the third group (21 subjects), a placebo

Table 2. Characteristics and outcome of the selected studies.

Studies	Subjects	Procedures	Follow-up	Outcome
Mulet[17]	45	OMT Self-care	4 weeks	OMT = Self care
de Felicio 2008[18]	28	OMT No treatment	135 days	OMT > No treatment
de Felicio 2010[19]	40	OMT Stabilization appliance No treatment	120 days	OMT > Stabilization appliance > No treatment
Machado[20]	102	LLLT + OME OMT Placebo LLLT + OME LLLT	7 months	LLLT + OME/OMT > LLLT > Placebo LLLT + OME (ProTMDmulti)

OMT: Oral myofunctional therapy; LLLT: low level laser therapy; OME: Oral myofunctional exercises.

LLLT was associated with OME; the fourth group (18 subjects) was treated with LLLT only. A group of 20 healthy subjects represented the asymptomatic control group. OMT exercises included the following: 1) Exercises of mobility, endurance, and strength for the lips, cheeks, tongue, and the jaw muscles; and 2) Orofacial function training. Subjects were evaluated for muscle and TMJ tenderness to palpation, TMD severity, assessed by the ProTMDmulti-part II questionnaire, and orofacial myofunctional status, at baseline, immediately after treatment, and at 7-month follow-up (3 months after treatment, which lasted 120 days). The results show a general decrease of the outcome measures, except for orofunctional functions, in all treated groups, with stability at follow-up. However, LLLT combined with OME and OMT were more effective than LLLT alone, both for reducing TMD symptoms and to rehabilitate orofacial function. The characteristics and outcome of the studies are summarized in Table 2.

Discussion

The results of the studies included in this review seem to suggest that OMT is efficacious for the treatment of temporomandibular disorders, both alone or in combination with other conservative treatments, such as LLLT. This seems to confirm the results of other studies, where a positive effect of OMT was reported in TMD patients, although very few studies have been published on the topic [7,21]. De Oliveira Melchior et al. [7] describe a significant decrease of signs and symptoms intensity and increase of mobility and function of the orofacial structures in patients previously treated with LLLT, but with recurrence of pain. Messina et al. report a reduction of facial pain intensity in TMD patients with bruxism, as well as reduction of bruxism episodes per hour [21]. However, these studies were carried out with a limited number of patients and did not include a control group [7,21]. In addition, OMT is a collective term that includes many different treatment strategies commonly used in TMD patients, such as patients' information about the disorder, control of dysfunctional behaviors (oral parafunctions), thermotherapy (warm compresses and cold packs), relaxation techniques, posture training, and jaw exercises, associated with more specific OME, such as exercises for the tongue, lips, and cheeks (mobility, endurance, muscle strength); therefore, it is difficult to differentiate such results from the results obtained by other studies using a similar treatment without specific OME [7,21]. For example, in a study by Nicolakis et al. [5], a group of patients with a diagnosis of disc displacement without reduction was treated with active and passive jaw movement exercises, correction of body posture, and relaxation techniques. At 6-month follow-up, 7 out of 18 patients reported complete remission of pain, and 9 patients displayed a normal incisal edge clearance [5]. Michelotti et al. [22] evaluated the effect of education associated with a home physical therapy program, including self-relaxation exercises with diaphragmatic breathing, self-massage of the muscles of mastication, moist heat pad application to the painful muscles, and stretching and coordination exercises of the masticatory muscles in patients with myofascial pain. Their results showed a success rate of 77% after 3 months, although a non-treatment group was not included in the trial; therefore, the possibility of natural healing of the disease and regression to the mean phenomenon could not be ruled out [23]. However, three recent systematic reviews of the literature examining different types of manual therapy and therapeutic exercises summarized that exercise programs show a positive effect to treat myogenous and arthrogenous TMD [24–26]. Specifically, interventions based on exercises to correct head and neck posture and active and passive oral exercises reduce musculoskeletal pain and improve oromotor function [24–26]. No high-quality evidence supports such results; still, those treatments are safe and simple interventions that could be beneficial for TMD patients [24–26]. This confirms that it is very difficult to understand if OMT has a more beneficial effect when compared with other types of therapeutic exercises commonly used, usually in addition to other conservative treatments, such as dental appliances and medications, for the management of

TMD. In fact, the study by Mulet et al. [17] showed a positive effect of a series of exercises for the tongue, neck, shoulders, and jaw, associated with a self-care program for the treatment of myofascial pain, but the same effect was also achieved in the group treated with the self-care program only.

This review also has some limitations owing to the limited number of studies found, examining a very limited population of patients, and the low quality of most of the studies, especially due to lack of blinding procedures both for patients and clinicians. In addition, three out of four of the articles collected and evaluated were written and published by the same group of authors, from the department of otorhinolaryngology, ophthalmology, and head and neck surgery of the University of São Paulo (Brasil). This lack of different points of view reduces the reliability of the results.

Conclusion

Even though scientific evidence is weak because of the limited number and low quality of RCTs available in the literature, OMT, like other conservative and reversible treatments, has favorable cost-benefit and risk-benefit ratios; therefore, such therapy can be advised for patients with TMD and associated orofacial myofunctional disorders [4].

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Disclosure statement

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