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Review Article

Acupuncture for Myofascial Pain of the Masticatory Muscles Management

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Abstract

Temporomandibular disorders are currently highly prevalent, especially in modern societies. Their management is demanding and needs multidisciplinary approach. Acupuncture is recognized as one of the treatment modalities of masticatory muscles' myofascial pain. Authors searched the PubMed, Cochrane Library, and Scopus databases for papers describing usefulness of acupuncture and dry needling in the treatment of myofascial pain of the masticatory muscles. The inclusion criteria were: clinical trials, systematic reviews and meta-analyses regarding application of acupuncture for myofascial pain treatment among adults, that where published in English language between January 2000 and May 2018 as full-text and peer-reviewed journal articles. Initially authors obtained 113 results, of which 19 papers were included. Main outcome of acupuncture therapy was analgesic effect, which was presented as a reduction of subjective pain on visual analogue scale (VAS). Included studies had limitations, of which the most common was a small sample size. Standard acupuncture and dry needling should be considered as beneficial methods for myofascial pain management in patients with masticatory muscles disorders.

ABBREVIATIONS

VAS: Visual Analogue Scale; TMD: Temporomandibular Disorders; TMJ: Temporomandibular Joint; MFP: Myofascial Pain; MTP: Myofascial Trigger Points; TCM: Traditional Chinese Medicine

INTRODUCTION

Temporomandibular disorders (TMD) are currently very common health care problem of modern societies. They are a major reason of non-odontogenic pain in the orofacial region that can refer to masticatory muscles, periauricular region, teeth, and temporomandibular joint (TMJ) [1]. According to the currently recommended diagnostic criteria, the term TMD involves array of possible diagnoses such as pain disorders (myalgia, myofascial pain, arthralgia, headache attributed to TMD) and temporomandibular joint disorders (disc displacement, degenerative joint disease, dislocation) [2]. Due to multifactorial origins of TMD and overlapping symptoms of other entitles coexisting in the same individuals, the diagnosis is often confusing and the treatment is very demanding. The therapeutic approach requires clinicians to have deep interdisciplinary knowledge and management expertise of patient and the disease. There are lots of treatment modalities of pain in masticatory muscles, including: therapeutic exercises, occlusal splint therapy, physiotherapeutic techniques, oral drug therapy, injectable pharmacotherapy, surgical procedures, and acupuncture [3].

The aim of this paper was to carry out a non-systematic review of clinical trials, systematic reviews and meta-analyses for better understanding the effectiveness of acupuncture as a method of the MFP therapy in TMD patients.

MATERIAL AND METHODS

A non-systematic search for studies on the role of acupuncture for myofascial pain of the masticatory muscles management was carried out in three databases: PubMed, Cochrane Library, and Scopus. The following search keywords consistent with Medical Subject Headings terminology were used: 'acupuncture', 'temporomandibular join disorders', 'masticatory muscles', and 'myofascial pain syndromes'. Authors searched for clinical trials, systematic reviews and meta-analyses regarding application of acupuncture in MFP treatment among adults, that where published in English language between January 2000 and May 2018 as full-text and peer-reviewed journal articles. Firstly, titles and abstracts were screened for their potential validity in the context of the acupuncture and myofascial pain. Then the full texts of potentially suitable articles were evaluated according to research topic. The authors have excluded reviews, case studies and studies without evidence-base background. All authors (NG, JS) conducted the search. After the databases and reference lists screening we obtained 113 results, of which 18 papers were included with accordance to the defined criteria. One systematic review and meta-analysis was added during a peer review process. Eventually, the present review embraced 19 studies.

DISCUSSION AND CONCLUSION

The Diagnostic Criteria for TMD describe the clinical features of the myofascial pain (MFP) as a pain of muscle origin that is

affected by jaw movement, function, and replication of this pain occurs with provocation testing of the masticatory muscles. During myofascial examination the pain spreads beyond the side of palpation with or beyond the boundary of the muscle being palpated [2]. MFP is related to hyper contracted and painful areas located in the muscle, known as myofascial trigger points (MTPs). MTP is defined as 'a hyperirritable spot, usually within a taut band of skeletal muscle or in the muscle's fascia that is painful on compression'. Moreover, it can give rise to referred pain, tenderness, motor dysfunction, and even autonomic symptoms [4]. MTP forms at the neuromuscular junction of injured or overworked muscle, where an excessive amount of acetylcholine from the presynaptic nerve terminals affects receptors in the postsynaptic sarcolemma. This intense neural activation leads to sustained sarcoplasmic reticulum calcium release. Calcium concentration, which increases progressively, triggers and sustains contraction of the muscle fiber [5].

One of the conservative treatment modalities for MFP is acupuncture [3]. Body needling originated in China over 3,000 years ago. However, it is important to distinguish Traditional Chinese Medicine (TCM) acupuncture from MTPs needling. TCM acupuncture assumes insertion of fine needles at specific body regions, known as acupoints. According to Chinese concept of the physiology the acupoints create a network of 'meridians' that represent life energy channels running longitudinally along the human body surface. Disruption of the meridian channel network is believed to be associated with disease and/ or pain disorder, while placing a needle into specific acupuncture point restores the balance and positively influences bodily functions [6]. Although, the MTPs needling approach has roots in TCM, it rejects the traditional based philosophy of acupoints and energy flow [7]. Moreover, the clinical procedure of so-called 'dry needling' (without any substance) is slightly different. Dissimilarities concerns: amount of inserting needles and their depth, the movement of the needle, applied force of stimulation, and 'local twitch response' that leads to release [8].

An attempt of scientific community to clarify the role of needling for MFP management, contributed to the development of many studies with common features like: numerical superiority of women [9-18], small sample size [10,14,15,18,19], and middle-aged participants [9,10,12,13]. Most frequent outcome was the short-term analgesic effect of acupuncture. Often the therapeutic effect of acupuncture or dry needling was compared to sham acupuncture or sham dry needling, splint therapy or drug administration [13,17]. Most common limitations of the studies, except small sample size, were: lack of control group, lack of placebo group, no blinding, and short or lack of follow-up period. Table 1 presents an overview of the content and drawbacks of included studies.

Five studies included to the review concerned standard acupuncture. There are many acupoints that can be involved in TMD treatment. They can be divided into three groups: a group of points over and in relation with TMJ (ST5, ST6, ST7, ST7$^{1}/_{2}$, SI18, Si19, BG8 and EX2), points in the neck region related to headache therapy (GB20, GB21) and points on the top of the head, which are known to induce relaxation (GV20, EX6) [9]. Moreover, there is one distant point (LI4) commonly used for head and neck pain management. It is located between the thumb and index finger at adductor of pollicis [10]. Three randomized, blinded, and sham-controlled trials evaluated the effectiveness of acupuncture in treating MFP. Shen at al. examined the usefulness of LI4 point needling for headache, facial and neck pain reduction, as well as increasing masseter mechanical pain tolerance. Significant efficacy of acupuncture beyond sham acupuncture was demonstrated only for increasing masseter muscle pain tolerance [10]. However, in subsequent clinical trial published two years after, the same author showed that individuals receiving real acupuncture exhibited significant reduction in facial and neck pain too [11]. Smith et al. demonstrated that in a group subjected to real acupuncture at ST7 point significant improvement in pain intensity, and opening movements range, as well as reduction of lateral pterygoid tenderness occurred [12]. Grillo et al., showed more than a fivefold reduction in pain intensity and increase in pain-free mouth opening range from 36.95 to 42.35 after acupuncture intervention ($P \leq 0.05$). The benefits were comparable to splint therapy [13]. Reports obtained by Schmid-Schwap et al., are controversial. The authors of the randomized control trial suggested significantly higher reduction of subjective pain in the acupuncture group as compared to placebo group, even when the pretreatment and post treatment values among both groups were no significantly different [14].

Most of studies on dry needling of MTP in masticatory muscles showed a positive effect of the therapy. Depending on the research the results of the needling were testing form 5 minutes after the therapeutic intervention [15], up to 6 months after [16]. Gonzalez-Perez at al. in one of two studies on deep dry needling of MTP in the lateral pterygoid muscle, demonstrated that this therapy reduced the MFP during 6 months of follow-up period, especially in patients who had high baseline scores in visual analogue scale. Mean mouth opening value at 6 months after treatment increased from 2.90 cm to 4.5 cm [16]. In the second study the deep dry needling was compared with methocarbamol/paracetamol medication. The drug administration had significantly lower level of pain reduction. Forty-one percent of individuals described unpleasant side effects of medication, whereas in needling group no patient exhibited any side effects. Assessments at the 28th and 70th day showed significant improvements of lateral movements and protrusion compared with drug-treated group [17]. Two papers, aside from subjective pain evaluation, examined the effect of dry needling of active MTPs on pressure pain threshold with algometer. Both showed significant improvements in pressure pain threshold score [15,18]. Itoh et al. in sham-controlled trial indicated that the mean visual analog scale score decreased significantly both in experimental and placebo group. There was no influence on mandibular movements [19].

Standard acupuncture and dry needling of trigger points seem to be equally effective. Some authors claimed that traditional acupoints on the masticatory muscles often seem to correspond with localization of MTPs [7].

There are examples of studies presenting a new acupuncture approaches like microsystem acupuncture [20,21] and laser acupuncture [14,22-24]. These modern methods seem to be promising in MFP modulation among TMD patients.

As there is a lack of studies in large population samples, meta-

Table 1: An overview of the content of included studies.

Authors (year)	Type of intervention	Study design	Studied sample (average age ± SD)	Number and duration of sessions	Follow-up after the last intervention	Outcomes
Rosted et al. (2006) [9]	Standard acupuncture	RCS (no randomization, controls, placebo, and blinding)	N = 60 (40.6) 83% females	On average 3.4 sessions lasting 12.3 min	No	85% of patients respond to the treatment. Almost threefold decreased in pain score (VAS); P<0.001
Shen et al. (2007) [10]	Standard acupuncture	RCT (placebo-controlled: non-penetrating skin sham acupuncture, single-blind)	N = 15 (43.1 ± 13.6) 93% females	1 session lasting 15 min	No	Significant increase in pain tolerance during mechanical stimulus of masseter muscle (11-point NRS); P<0.027
Shen et al. (2009) [11]	Standard acupuncture	RCT (placebo-controlled: non-penetrating skin sham acupuncture, single-blind)	N = 28 100% females	1 session lasting 15 min	No	Significant decrease in jaw pain, jaw tightness, neck pain (P= 0.04, for all); increase in pain tolerance during mechanical stimulus of masseter muscle (11-point NRS); P<0.01
Smith et al. (2007) [12]	Standard acupuncture	RCT (placebo-controlled: non-penetrating skin sham acupuncture, double-blind)	N = 27 (40.5 ± 13.63) 81% females	6 sessions lasting 20 min	Assessment 3and 7days after last intervention	Significant improvement in pain intensity (VAS) P=0.003, maximum pain-free opening P=0.000, and reduction of lateral pterygoid tenderness (functional manipulation) P=0.014.
Grillo et al. (2015) [13]	Standard acupuncture,	RCT (no blinding, no placebo, occlusal splint group as control)	N = 40 (30 ± 6.59) 100% females	4 sessions lasting 20 min	No	Standard acupuncture is as effective as splint therapy in pain reduction and improvement in maximum pain-free mouth opening.
Schmid-Schwapet al. (2006) [14]	Standard acupuncture, Intraoral acupuncture,	RCT (placebo-controlled: sham laser acupuncture, single-blind)	N = 23 100% females	1 session lasting 20 min	No	The pretreatment and post treatment VAS scores were no significantly different.
Fernández-Carneroet al. (2010) [15]	Dry needling	RCT (placebo-controlled: penetrating skin sham acupuncture, double-blind)	N = 12 (25 ± 6) 100% females	2 sessions at interval at least 7 days	No	Greater improvement in active mouth opening range and increase in PPT level in masseter muscle; P<0.001.
Gonzalez-Perez et al. (2010) [16]	Dry needling	PCS (no randomization, controls, placebo, and blinding)	N = 36 (27 ± 6.5) 83% females	3 sessions at interval of 1 week	Assessment 2 weeks, 1, 2 and 6 months after	Reduction in the MFP during 6 months of follow-up period, especially in patients who had high baseline VAS scores.
Gonzalez-Perez et al. (2012) [17]	Dry needling,	RCT (no blinding, no placebo, drug-treated group as control)	N = 48 (34.3 ± 13.8) 79% females	1 session once per week for three weeks	Assessment 2 and 8 weeks after	Statistical significant pain reduction (better than controls) VAS; P<0.05.
Blasco-Bonoraet al. (2017) [18]	Dry needling	PCS (no randomization, controls, placebo, and blinding)	N = 17 (39 ± 13) 65% females	1 session	Assessment 1 week after	Significant pain reduction immediately and 1 week after the intervention (VAS); P<0.001.
Itoh et al. (2012) [19]	Dry needling	RCT (placebo-controlled: non-penetrating skin sham acupuncture, single-blind)	N = 16 31% females	3 sessions lasting 30 min	Assessment 10 week after	Reduction in pain intensity between pretreatment and 5 weeks after MTP (P<0.001) and sham acupuncture (VAS); P<0.05.
Simmaet al. (2018) [20]	Microsystem acupuncture, Intraoral acupuncture, Standard acupuncture	RCS (no randomization, controls, placebo, and blinding)	N = 407 (45 ± 1.5) 77% females	1 session	No	Decrease of pain intensity during palpation in temporal, masseter, andpterygoid muscle (4-point Likert scale); P<0.001
Simmaet al. (2009) [21]	Microsystem acupuncture, Intraoral acupuncture, Standard acupuncture,	RCT (placebo-controlled: sham laser acupuncture, double-blind)	N = 23 100% females	1 session	No	Overall pain reduction assessed by palpation of 14 muscles (P<0.001) and VAS (P<0.031) were significantly reduced after acupuncture.

Ferreira et al. (2013) [22]	Laser acupuncture, Occlusal splint therapy	RCT (placebo-controlled: sham laser acupuncture, double-blind)	N = 40 (34.17 ± 8.83)	1 session lasting 90 s once a week for 3 months	No	Significantly faster reduction and lower pain intensity in group receiving laser acupuncture as adjunct to occlusal splint therapy (VAS); P<0.002
Hotta et al. (2010) [23]	Laser acupuncture,	PCS (no randomization, controls, placebo, and blinding)	N = 10 (35.3) 90% females	1 session lasting 20 s once a week for ten weeks	No	Significant improvement in painful symptoms of masseter muscle in habitual occlusion (VAS); P<0.01
Katsouliset al. (2010) [24]	Laser acupuncture,	RCT Pilot study	N = 11 (33) 90% females	1 session lasting 15 min twice a week for three weeks	Assessment 16 week after	Pain reduction in all groups (VAS).
Wu et al. (2017) [25]	Standard acupuncture, Dry needling	Meta-analysis (9 studies)	N = 231	N/A	N/A	Significant reduction of pain following acupuncture treatment (VAS). P=0.003
Fernandes et al. (2017) [26]	Standard acupuncture, Dry needling, Laser acupuncture	Systematic review (4 studies)	N = 99	N/A	N/A	Significant reduction of MFP, however due to the quality of the analyzed studies the evidence is limited.
Jung et al. (2011) [27]	Standard acupuncture, Laser acupuncture	Systematic review and meta-analysis (7 studies)	N = 141 (37.3) 95% females	N/A	N/A	Limited evidence that acupuncture in more effective than sham acupuncture in pain relief and masseter muscle tenderness.

Abbreviations: RCS: Retrospective Case series; VAS: Visual Analogue Scale; RCT: Randomized Clinical Trial; NRS: numerical rating scale; PPT: Pressure Pain Threshold; PCS: Prospective Cohort Study; MFP: Myofascial Pain; PCS: Prospective Case series;

analyses and systematic reviews allow scientists summarizing outcomes from independent studies, provided that they meet specified inclusion criteria for analyzing. Though discussions and questionable reports of the efficacy of standard acupuncture and dry needling Wu et al. performed meta-analyses and concluded that acupuncture therapy is effective in reducing the pain in TMD patients, especially those with MFP [25]. However, Fernandez et al. in a systematic review, due to limited quality of the analyzed studies, proposed more careful conclusions. Although, the study showed significant effects of acupuncture in MFP modulation, it underlined a need for other controlled and randomized clinical trials [26].

Interestingly, some randomized clinical trials demonstrated significant and positive effects not only in a group receiving real acupuncture, but also in placebo (sham) groups [10,12,14,19]. Shen et al. showed that subjects who believed that they had received real acupuncture, had a significant decrease in facial pain (P=0.003), neck pain (P=0.011), and headache (P=0.015), even though no significant benefits were obtained considering actual real acupuncture group [10]. Jung et al. in a meta-analysis reported significant positive effect of acupuncture on masticatory muscle tenderness and pain intensity reduction, nonetheless the analysis indicated that the evidence that acupuncture is more effective than sham acupuncture is limited [27,28].

Literature suggests that the psychological factors could play an important role in this group of patients, and it has already been underlined in the literature [29,30]. Myofascial pain of masticatory muscles management is demanding and needs multidisciplinary approach. For this reason, acupuncture should be considered as complementary therapy.

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