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Research Article

Treatments of Orofacial Muscle Pain: A Review of Current Literature

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Abstract

Background: There are a large number of treatment options for Orofacial Muscle Pain (OMP). It remains uncertain which treatments are the most effective when it comes to reducing spontaneous pain resulting from OMP.

Objective: The purpose of the present paper is to review the controlled medical/dental studies related to the treatment of OMP.

Methods: For an inventory of the treatments, we researched the literature without time limit and with PubMed® as the search engine, using the term OMP as well as the numerous synonyms encountered while reviewing the papers generated. We focused on effects of treatment on spontaneous pain. We divided the treatment studies into negative-controlled and non-controlled studies and analyzed them separately.

Results: The literature search generated 58 studies on 18 different treatment options, each including 9 to 90 patients. Of 13 treatments the effect on spontaneous pain was studied compared to a negative-controlled group. The treatments that showed benefit in randomized, blinded, negative-controlled studies were: myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin.

Conclusions: A number of studies lacked a negative control and were underpowered as to the number of subjects included. The reviewed studies suggest efficacy for6 different treatments: myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin.

Keywords: Face pain; Orofacial muscle pain; Temporomandibular disorder; Masseter myalgia; Spontaneous pain

Introduction

Chronic orofacial pain is relatively common and affects an estimated 7% of the general Western population [1]. It is commonly caused by Orofacial Muscle Pain (OMP), with pain located peripherally in the face or in the jaw(s), non-neuropathic in nature, and generally continuously present [2]. The pain of OMP originates from the muscles of mastication, particularly the masseter muscles. The cause is a dysfunction of those muscles, resulting in myalgia [3]. In the most recent classification for temporomandibular disorders, myalgia is a subcategory within muscle pain of the masticatory muscles and it assembles: local myalgia, myofascial pain and myofascial pain with referral. It should be distinguished from tendonitis, spasm and myositis [4].

In the literature, OMP is described under a great variety of terms as listed (Table 1). There is a wide range of treatment options available for OMP with the primary purpose of reducing spontaneous pain in these patients. Despite the fact that orofacial pain caused by OMP is a commonly encountered problem, it remains uncertain which treatments are most effective. This results in large practice variety, suboptimal treatment, and prolonged disability. Therefore, we aimed to review the current literature on the treatments of OMP.

Methods

Using the terms listed in Table 1, we conducted extensive research of the literature on the medical/dental treatments of OMP. We used PubMed® as the search engine and applied no time limit. We performed the search in November 2016. Only studies in English that reported spontaneous pain scores in humans as an outcome measure were included and studies that reported surrogate endpoints only, such as pressure pain threshold or un-assisted mouth opening, were not included. The treatment should have been performed in patients with OMP only and not in mixed patient populations (i.e., patients with other temporomandibular disorders). Case reports, i.e., series of less than five patients, were excluded. The studies were analyzed in two sections: negative-controlled studies (placebo-, sham-, and waiting list-controlled) and non-controlled studies. Comparative studies without a negative control were analyzed under the section of non-controlled studies, separately for the treatments compared.

Results

Fifty eight studies met our selection criteria, each including 9 to 90 patients. Of 18 different treatments, the effect on spontaneous pain resulting from OMP was investigated (Table 2).Twenty eight studies used a negative control group, concerning 13 different treatments

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Table 1: Myofascial Temporomandibular Disorder (TMD): synonymous terminology.

Facial pain with masticatory hyperactivity
Masseter muscle pain
Masseter myalgia
Masticatory muscle pain
Masticatory muscle spasm
Masticatory myofascial pain
Myalgia of the masseter muscles
Myalgia of the masticatory system
Myofascial pain of the jaw muscles
Myofascial pain of the masticatory muscles
Myofascial pain syndrome of the masticatory muscles
Myofascial temporomandibular pain
Myogenic temporomandibular disorder
Myogenouscraniomandibular disorder
Myogenous facial pain
Myogenous orofacial pain
Myogenous pain of the masticatory muscles
Myogenous temporomandibular disorder
Orofacial muscle pain
Orofacial pain of muscular origin
Pain in the masticatory muscles
Tendomyopathy of the masticatory musculature
Temporomandibular disorder with myofascial pain
Temporomandibular disorder of myogenous origin
Temporomandibular disorder with pain in the masticatory muscles
Temporomandibular myofascial pain

(73%; Table 3). Eight treatments (44%) were studied in both negative and non-negative controlled studies and 5 treatments (27%) were only studied with-out negative control (Table 4).

The treatments that showed benefit in randomized, blinded, negative-controlled studies were: myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin (Table 3). Myofascial therapy showed effect on spontaneous pain in one rater-blinded, randomized study (61 patients) [5]. Laser was effective in two double-blinded, randomized studies (16-58 patients). [6,7]. Four other studies, of which 3 were single or double blinded and 3 were randomized, showed no effect of laser (9-21 patients) [8-11]. Botulinum toxin was effective in one single-blinded, randomized study (90 patients) [12]. In the other three double-blinded, randomized studies, no effect was shown (10-20 patients) [13-15]. Ping on ointment, melatonin, and gabapentin were all effective in single, double-blinded, randomized studies [16-18]. Treatment with stabilization appliance was effective in two non-blinded studies, of which one was randomized (40 and 76 patients, respectively) [19,20]. Three other studies, of which two were double-blinded and randomized, showed no effect [21-23]. Partial coverage appliance was effective in one non-blinded, non-randomized study [20]. Acupuncture was not effective in three studies [24-26]. Dry needling

Table 2: Treatments of myofascial Temporomandibular Disorder (TMD) evaluated in (negative-) controlled and non-controlled studies.

Treatment	*Controlled studies*	*Non-controlled studies*
Self-care	0	3
Myofascial therapy	1	4
Chiropractic therapy	0	1
Electrical stimulation	0	1
Laser	6	3
Dry needling	1	1
Acupuncture	3	1
Stabilization appliance	4	8
Partial-coverage appliance	1	1
TheraBite®	0	1
NTI[a](-like) appliance	0	1
Botulinum toxin	4	3
Melatonin	1	0
Gabapentin	1	0
Ping on ointment	1	0
Muscle relaxants	1	0
Analgesics	2	0
Muscle relaxants and analgesics	2	2

[a]Nociceptive trigeminal inhibition

showed no effect in one study [27]. NSAIDs, muscle relaxants, alone or in combination, were not effective either [28,29]. Self-care, chiropractic therapy, electrical stimulation, NTI (-like) appliance, and TheraBite® were only studied in small non-negative-controlled studies (10-38 patients).

Discussion

In this review, we gathered all published studies that investigated treatments of OMP and their effect on spontaneous pain. Fifty eight studies met our selection criteria, investigating the effect of 18 different treatments. The studies that were blinded randomized and compared treatment effect to negative controls showed effect for: myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin.

We considered negative-controlled studies that were blinded and randomized as best available evidence. Six treatments showed to be effective in spontaneous pain reduction in this study design: myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin. Myofascial therapy, ping on ointment, melatonin, and gabapentin showed effect in one study each [5,16-18]. For these modalities, there were no other studies to confirm this effect. Laser was effective in 2 out of 6 negative-controlled studies. Of the two positive studies, one was clearly larger than the rest (58 versus ≤ 21 patients) [6-11]. Botulinum toxin was effective in one out of 4, which was also clearly the largest study (90 versus ≤ 20 patients) [12-15].

Stabilization appliance was only effective in two non-blinded studies [19,20] and not in three other studies of which two were double-blinded and randomized [21-23]. Partial coverage appliance was only effective in one non-blinded, non-randomized study [20].

Table 3: Placebo-, sham-, and waiting-list-controlled studies in myofascial temporomandibular disorder.

Author(s)	*Blinding*	*Randomized*	*Design*	*Number of subjects*[a]	*Treatment*	*Positive outcome*[b]
Kalamiret al. (2012) [5]	Rater	Yes	Parallel	61[c]	Myofascial therapy	Yes[d]
Shiraniet al. (2009) [6]	Double	Yes	Parallel	16	Laser	Yes
Godoy et al. (2015) [8]	Single	Yes	Parallel	9	Laser	No
Maia et al. (2012) [9]	No	No	unclear	21	Laser	No
Ahari et al. (2014) [11]	Double	Yes	Parallel	20	Laser	No
Conti et al. (1997) [10]	Double	Yes	Parallel	10	Laser	No
Salmos-Brito (2012) [7]	Double	Yes	Parallel	58	Laser	Yes
Goddard et al. (2002) [27]	Double	Yes	Parallel	18	Dry needling	No
Shen & Goddard (2007) [25]	Single	Yes	Parallel	15	Acupuncture	No
Shen et al. (2009) [24]	Single	Yes	Parallel	28	Acupuncture	No
Katsouliset al. (2010) [26]	No	No	Parallel	11	Acupuncture	No
Dao et al. (1994) [23]	Double	Yes	Parallel	61	Stabilization appliance	No
Ekberg et al. (2003) [22]	Double	Yes	Parallel	60	Stabilization appliance	No
Daif (2012) [19]	No	Yes	Parallel	40	Stabilization appliance	Yes
Qvintuset al. (2015) [21]	No	Yes	Parallel	80	Stabilization appliance	No
Al Quran & Kamal (2006) [20]	No	No	Parallel	76	Stabilization appliance	Yes
Al Quran & Kamal (2006) [20]	No	No	Parallel	76	Partial-coverage appliance	Yes
Kurtogluet al. (2008) [14]	Double	Yes	Parallel	20	Botulinum toxin	No
Von Lindernet al. (2003) [12]	Single	Yes	Parallel	90	Botulinum toxin	Yes
Nixdorf et al. (2002) [13]	Double	Yes	Cross-over	10[c]	Botulinum toxin	No[d]
Ernberget al. (2011) [15]	Double	Yes	Cross-over	20[c]	Botulinum toxin	No[d]
Li et al. (2009) [16]	Double	Yes; 1 study	Parallel	45[c]	Ping On ointment	Yes[d]
Vidor et al. (2013) [17]	Double	Yes 1 study	Parallel	32	Melatonin	Yes
Kimoset al. (2007) [18]	Double	Yes 1 study	Parallel	44	Gabapentin	Yes
Varoliet al. (2015) [29]	Double	Yes	Cross-over	18	Diclofenac	No
					Panacea[e]	No
Singer & Dionne (1997) [28]	Double	Yes	Parallel	39[c]	Diazepam	No[d]
					Ibuprofen	No
					Combination	No

[a] Total number of subjects in treatment group with controls. When multiple treatment options were given patients of the specific treatment in the table and control are provided.
[b] Statistically significant group difference ($p<0.05$).
[c] Completers.
[d] Completer analysis.
[e] diclofenac+ carisoprodol+ acetaminophen+ caffeine

Therefore and based on the available evidence, we consider the stabilization and partial coverage appliances ineffective. Negative controlled studies showed that the following treatments were not effective in reducing spontaneous pain: dry needling, acupuncture, NSAIDs, muscle relaxants, and NSAIDS combined with muscle relaxants. For the treatments that were only studied in small, non-negative controlled studies (self-care, chiropractic therapy, electrical stimulation, NTI(-like) appliance, and TheraBite®) the effect on spontaneous pain remains unsure [30-36].

Considering the muscular mechanism of the pain in OMP, it is not surprising that myofascial therapy, laser, and botulinum toxin are potentially beneficial. Ping on ointment has been used as soothing massage balmas the oils they contain are considered to be anti-inflammatory and have peripheral analgesic effects [16]. The effect of melatonin is suggested to result from improved sleep, which is usually disturbed in OMP [17]. The possible effect of gabapentin, which is generally considered a medication effective in neuropathic pain. The authors suggested myofascial TMD to be a problem of central pain perception rather than of local (muscle) tissue injury [18]. They base their assumption on a study, where it was shown that patients with masticatory muscle pain have increased sensitivity to pressure stimulation of masseter- and temporalis-muscle sites only and not of peripheral non-painful finger sites, compared to controls [37]. Also in fibromyalgia, gabapentin may possibly provide therapeutic benefit [38,39].

Overall, the quality of the studies was not very high, with

Table 4: Non-controlled treatment studies in myofascial temporomandibular disorder.

Author(s)	*Number of subjects*	*Treatment*	*Positive outcome* [a]
Michelottiet al. (2004) [36]	23[b]	Self-care	No[c]
Michelottiet al. (2012) [35]	23	Self-care	Yes
Gavishet al. (2006) [32]	10	Self-care	No
Michelottiet al. (2004) [36]	26[b]	Myofascial therapy + self-care	No[c]
Guarda-Nardiniet al. (2012) [41]	15	Myofascial therapy	No
Gavishet al. (2006) [32]	10	Myofascial therapy	Yes
Kraaijengaet al. (2014) [34]	41	Myofascial therapy	Yes[c]
DeVochtet al. (2013) [31]	20	Chiropractic therapy	No
Almeida et al. (2009) [30]	12	Electrical stimulation	Yes
Tullberget al. (2003) [42]	12	Laser	No
Özet al. (2010) [43]	40[b]	Laser	Yes[c]
Melchior et al. (2014) [44]	12	Laser	No
Gonzalez-Perez et al. (2015) [45]	23[b]	Dry needling	Yes[c]
Grilloet al. (2015) [46]	20	Acupuncture	Yes
Naikmasuret al. (2008) [47]	20	Stabilization appliance	Yes
Nilneret al. (2008) [48]	33	Stabilization appliance	Yes
Özet al. (2010) [43]	20[b]	Stabilization appliance	Yes[c]
Jokstadet al. (2005) [33]	20	Stabilization appliance	Yes
Michelottiet al. (2012) [35]	18[b]	Stabilization appliance	No[c]
Grilloet al. (2015) [46]	20	Stabilization appliance	Yes
Vilanovaet al. (2014) [49]	50[b]	Stabilization appliance	Yes
DeVochtet al. (2013) [31]	20	Stabilization appliance	No
Nilneret al. (2008) [48]	32	Partial-coverage appliance	Yes
Jokstadet al. (2012) [33]	18[b]	NTI(-like) appliance[d]	Yes[c]
Kraaijengaet al. (2014) [34]	38	TheraBite®	Yes[c]
Guarda-Nardiniet al. (2012) [41]	15	Botulinum toxin	No
Pihut*et al.* (2016) [50]	42	Botulinum toxin	Yes
Sidebottom *et al.* (2013) [51]	62	Botulinum toxin	Yes
Naikmasuret al. (2008) [47]	20	Muscle relaxants and analgesics	Yes
Gonzalez-Perez et al. (2015) [45]	16[b]	Muscle relaxants and analgesics	No[c]

many studies lacking a negative control. Fur-thermore, all studies included limited numbers of patients (9-90), resulting in them being underpowered. Also, only a few of the studies that showed treatment effects were replicated. Therefore, no hard conclusions can be drawn on what the best treatment is for reducing spontaneous pain from OMP.

Given the limitations of this review, the best available evidence for treatments to be used in clinical practice based on our findings are: myofascial therapy, laser, botulinum toxin, and ping on ointment, melatonin, and gabapentin. We suggest that the ultimate choice of treatment is made with this evidence in mind, on a personalized basis. When a patient presents with OMP and there is sleep problems involved, a combination of myofascial therapy, laser or ping on ointment with melatonin is reasonable to consider. If these treatment modalities fail, botulinum toxin or gabapentin may be considered as next step, despite their side effects. Botulinum toxin may be considered better in OMP treatment when spasm occurs concurrently or when there is evidence of very tight muscles. Gabapentin may be considered when the muscles are not that tense at all, and the cause of orofacial pain is considered to be primarily a pain perception problem. Furthermore patient preference for one of these treatments should be considered carefully. In randomized, controlled trials for diseases were multiple treatment options are available, patients with a treatment preference are usually excluded, which often leads to underestimation of the treatment benefit [40]. When the patient treatment preference is taken into account (shared decision making), the probability of treatment success will improve regardless of the choice of treatment.

More research in the form of randomized, double-blinded, negative-controlled studies is imperative, with special attention paid to the number of subjects included and, hence, the power of the studies, especially to confirm (myofascial therapy, laser, botulinum toxin, ping on ointment, melatonin, and gabapentin) or test (dry needling, acupuncture, and the treatments studied without negative

control) the effects of the studies reviewed.

Conclusion

While OMP as a cause of face pain and its clinical presentation seems well established, its medical/dental treatment in the various modalities has not been well researched. Based on the current literature, 6 out of 18 studied treatment modalities may be beneficial in reducing spontaneous pain in these patients.

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