Headache Attributed to Masticatory Myofascial Pain: Clinical Features and Management Outcomes

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Aims: To describe the characteristics of headaches attributed to temporomandibular disorders (TMD) and assess the effects of two management strategies used for the management of TMD on headache intensity and frequency. **Methods:** The initial sample (n = 60) of this randomized controlled trial comprised patients with masticatory myofascial pain according to the Research Diagnostic Criteria for TMD (RDC/TMD), and headache. The patients were divided into two groups: group 1 received only counseling for behavioral changes, and group 2 received counseling and an occlusal appliance. A 5-month follow-up period included three assessments. TMD-related headache characteristics, eg, headache intensity (scored on a visual analog scale [VAS]) and frequency were measured by a questionnaire. Two-way analysis of variance, chi-square, Friedman, and Mann-Whitney tests were used to test for differences considering a 5% significance level. **Results:** The main clinical features of headache attributed to masticatory myofascial pain were the long duration (≥ 4 hours), frontotemporal bilateral location, and a pressing/tightening quality. Forty-one subjects (group 1, 17 subjects; group 2, 24 subjects) were included in the final analysis. There was a reduction in headache intensity and frequency, with no significant differences between groups ($P > .05$). The mean (± SD) baseline VAS was 7.6 (± 2.2) for group 1 and 6.5 (± 1.6) for group 2; final values were 3.1 (± 2.2) ($P < .001$) and 2.5 (± 2.3) ($P < .001$), respectively. **Conclusion:** Headache attributed to masticatory myofascial pain was mainly characterized by long duration, frontotemporal bilateral location, and a pressing/tightening quality. Also, counseling and behavioral management of masticatory myofascial pain improved headache, regardless of the use of an occlusal appliance. *J Oral Facial Pain Headache 2015;29:323–330. doi: 10.11607/ofph.1394*

Keywords: *diagnosis, myofascial pain, occlusal splint, secondary headache, temporomandibular joint disorders*

The cephalic region is considered one of the areas most often affected by chronic pain.[1] In this scenario, temporomandibular disorders (TMD) and headaches hold prominent positions, each highly prevalent in the population.[2] TMD embrace a set of conditions that affect the masticatory system.[3] Masticatory myofascial pain is one of the most common forms of TMD and, in one-quarter of patients, is the major source of pain.[4] Its prominent signs and symptoms are facial pain, muscle tenderness/soreness, and headache.[3]

Briefly, headache could be a symptom of an underlying medical illness (secondary headache) or the illness itself (primary headache). It is difficult to differentiate between TMD and primary headache, especially when they coexist in a patient.[5] The most recent International Classification of Headache Disorders (ICHD 3–beta version[5]) defines the diagnostic criteria of a secondary headache as follows: temporal relation with the onset of the causative disorder, a significant worsening of the headache in parallel with the worsening of the causative disorder, a significant improvement of the headache in parallel with the improvement of the causative disorder, and/or the headache has characteristics typical of the causative disorder along with other evidence.[5]

Cross-sectional studies have already described a positive association between headache and myogenous TMD, suggesting that these entities are comorbid,[6–9] although little evidence exists to support a cause-effect relationship between the conditions.[10] One way to investigate this possibility is to test if there is an improvement of the headache after TMD management. Despite evidence suggesting that interventions to manage TMD may have a beneficial effect on headache, few randomized controlled studies have used clear diagnostic criteria to diagnose the headache type.[11–13]

Mostly, features of secondary headache are not properly described. Properly describing secondary headache features could impact clinical outcomes, since identification of headache characteristics may be helpful in establishing a correct diagnosis.[14] Even with updated and refined criteria for headache attributed to TMD, little is currently known about a specific headache clinical presentation that might be attributed to TMD.[15] Thus, the primary aim of this study was to describe the clinical characteristics of headache attributed to TMD, and the secondary aim was to compare the effects of two TMD management strategies (patient education or patient education and an occlusal appliance) on headache intensity and frequency. It was hypothesized a priori that *(1)* the headache found in subjects with a myogenous TMD is secondary to this condition and would improve after 5 months of TMD management, and *(2)* the combination of counseling for behavioral changes and an occlusal appliance would have a greater effect on headache intensity and frequency when compared with counseling alone after 5 months of treatment.

Materials and Methods

Sample

This study was a randomized controlled trial (RCT) conducted in Brazil and approved by the Ethics Committee on Human Research at the Bauru School of Dentistry, University of São Paulo official letter no. 040/2011. Eligible participants were adults aged between 18 and 50 years with masticatory myofascial pain according to the revised criteria of the Research Diagnostic Criteria for TMD (RDC/TMD)[16,17] and complaint of headache for at least 3 months. The sample included subjects *(1)* whose muscle pain was modified by function, *(2)* in whom muscle palpation elicited a familiar pain, and *(3)* whose headache began together with or became worse with the onset of masticatory myofascial pain. One professional examiner performed a careful clinical examination according to the RDC/TMD protocol[16,17] and a comprehensive interview in order to select subjects that fulfilled the above inclusive criteria. Headache information was recorded using a questionnaire based on the International Classification of Headache Disorders, 2nd edition (ICHD 2),[18] and each volunteer's detailed medical history was examined. During the examination, the patients had to answer positively to two questions: *(1)* Did your headache start together with the pain in your masticatory muscles? and *(2)* Did your headache significantly worsen in parallel with the progression of your pain in the masticatory muscles? Exclusion criteria were: occlusal risk factors for TMD,[19] chief complaint of temporomandibular joint pain, TMD or headache management performed in the last 3 months, a history of head trauma or other intracranial disorders, vascular disorders, medication overuse headache and other major causes of headache listed in the ICHD 2 (other than TMD),[18] use of medications that could affect the central nervous system (such as muscle relaxants, anticonvulsants, antidepressants, and anxiolytics), other causes of orofacial pain (such as caries, periodontal disease, or atypical odontalgia), and fibromyalgia.

The study took place at the Orofacial Pain Clinic of Bauru School of Dentistry from August 2011 to April 2013. The participants were recruited from the community by using advertisements. Informed consent from each selected subject was obtained after full explanation of the research purposes and procedures. The sample size was determined considering an anticipated dropout rate of 25% and a mean ± standard deviation (SD) difference of 2 (± 1.5) in visual analog scale (VAS) scores, with a power of 90% and a two-tailed significance level of 5%.

A flow diagram of the participants throughout the study, from recruitment to inclusion in the final analysis, is shown in Fig 1. Briefly, 236 subjects were assessed for eligibility between August 2011 and November 2012. However, 176 subjects did not meet the criteria. The inability to correctly define the chronological order, eg, whether the headache started together or became worse with the onset of masticatory myofascial pain, and medication overuse were the main reasons for exclusion. All those fulfilling the eligibility criteria accepted to participate and were assigned to group 1 or group 2 (see below). Thirteen participants in group 1 and six participants in group 2 dropped out of the study. Additionally, six subjects deviated from the protocol. In group 1, one subject requested the use of an occlusal appliance after 2 months of treatment, and three subjects started a pharmacologic treatment for headache after 2 months of treatment. In group 2, one subject started a pharmacologic treatment for headache after 2 months of treatment, and one subject started orthodontic treatment after 2 months of treatment. Thus, data from 17 and 24 participants for groups 1 and 2, respectively, were available for final analysis.

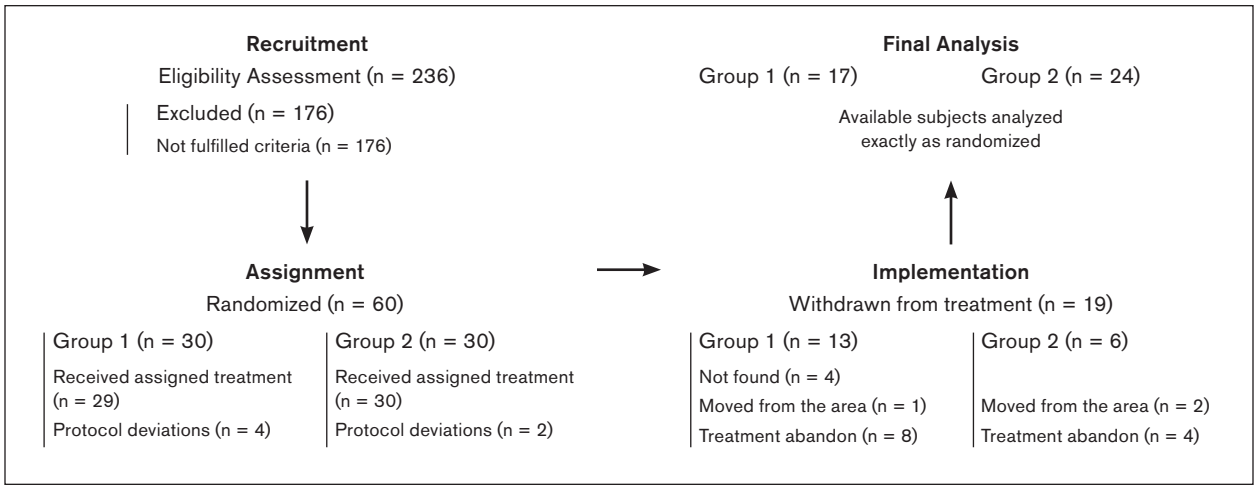

Fig 1 Flowchart of participants through the trial from recruitment to final analysis.

Treatment

All selected subjects (n = 60) were randomly assigned by a computer-generated list to receive counseling for habits and behavioral changes (group 1) or counseling and a stabilization appliance (group 2). The group allocation was concealed and performed using sequentially numbered, opaque, sealed envelopes by a person who did not know the allocation sequence. Counseling involved verbal and written instructions about TMD etiology and prognosis, diet modification in order to avoid hard foods, use of reminders to avoid parafunctional habits, relaxation exercises for the jaw muscles, application of a heating pad on painful muscles followed by stretching and self-massage, instructions about sleep hygiene, and incentives for social and aerobic activities. The suggested frequency for application of heating pads on painful muscles, followed by stretching and self-massage, was three to five times a week for at least 30 minutes each. One therapist was available full time to clarify any doubts related to the instructions. All instructions were clearly repeated during each assessment appointment.

The maxillary full-coverage occlusal appliance was made of hard acrylic and was fabricated in a dental laboratory. The occlusal surface was smooth and flat, with a thickness of 2 to 2.5 mm in the posterior region, and included an anterior guidance to allow for disocclusion of all posterior teeth during excursive movements. All splints were adjusted immediately after delivery, 1 week thereafter during a check-up session, as well as during the following assessments. Patients were instructed to wear the appliance only at night while sleeping.

The follow-up interval lasted 5 months with three assessments: baseline, month 2, and month 5. For each participant, all assessments were performed blinded for group allocation.

Variables

Headache characteristics (primary outcome) were assessed by means of a structured questionnaire based on the ICHD 2 criteria.[18] This questionnaire comprised 26 questions and provided information about headache features (frequency, duration, quality, side of pain, exacerbation with daily activity) and associated symptoms (aura, nausea, photophobia, phonophobia, and autonomic symptoms). The characteristics of headache attributed to masticatory myofascial pain were assessed only in those patients who reported at least a 50% reduction in pain intensity or frequency after 5 months of TMD management.

The secondary outcomes were headache intensity and frequency. Pain intensity was measured using a VAS with the anchor points "no pain" and "worst imaginable pain." The subjects were requested to tally a vertical mark on the line at the point that best represented the headache intensity during the previous month. Headache frequency was assessed using the questionnaire noted above. At baseline, headache frequency was defined according to ICHD 2 as infrequent (less than 1 day per month on average), frequent (1 to 14 days per month on average), and chronic (15 days or more per month on average).[18] At follow-up, the following definitions were used: absent (no headache complaint), infrequent, frequent, and chronic.

Statistical Analyses

Quantitative variables (age and VAS) were reported as means ± SD. The VAS values were tested for normality by using the Kolmogorov-Smirnov test. Sex and headache phenotypes were reported in percent.

The characteristics of the headache attributed to masticatory myofascial pain were described and a 95% confidence interval (CI) was determined. The proportion of headache improvement with respect to

Table 1 Demographics and Headache Description of All Included Participants

	Group 1* (n = 30)	Group 2 (n = 30)
Age, mean (± SD)	36 (± 6.7)	27.5 (± 6.7)
Sex, n (%)	27 (90) Female	27 (90) Female
Headache intensity, mean VAS-cm (± SD)	6.9 (± 2.0)	6.5 (± 1.8)
Headache frequency†, n (%)		
Infrequent	2 (6.6)	0 (0.0)
Frequent	11 (36.7)	19 (63.3)
Chronic	17 (56.7)	11 (36.7)
Headache phenotype, n (%)		
Migraine-like	13 (43.3)	11 (36.7)
Tension-type–like	17 (56.7)	19 (63.3)

*Randomization process assured that between-group dissimilarities were caused by chance.
†Frequency was defined according to the International Classification of Headache Disorders, 2nd Edition.[18]

Table 2 Characteristics of Headache Attributed to TMD of the 27 Patients Who Had at Least a 50% Reduction in Headache Intensity or Frequency After 5 Months of Treatment

Headache characteristics	
Intensity, VAS-cm; mean (± SD) [95% CI]	6.82 (± 1.9) [6.0 ± 7.5]
Frequency, % [95% CI]	
< 15 days/month	44 [25 ± 64]
≥ 15 days/month	55 [35 ± 74]
Duration, % [95% CI]	
< 4 hours/day	33 [16 ± 53]
≥ 4 hours/day	66 [46 ± 83]
Localization, % [95% CI]	
Unilateral (frontotemporal)	18 [6 ± 38]
Bilateral (frontotemporal)	92 [75 ± 99]
Retroccipital	40 [22 ± 61]
Quality, % [95% CI]	
Throbbing/pulsating	48 [28 ± 68]
Nonpulsating (pressing/tightening)	70 [49 ± 86]
Others (prickling, burning, shock)	22 [8 ± 42]
Associated symptoms, % [95% CI]	
Aggravated by physical activity	62 [42 ± 80]
Nausea/vomiting	55 [35 ± 74]
Photophobia	55 [35 ± 74]
Phonophobia	66 [46 ± 83]

VAS = visual analog scale; CI = confidence interval.

group allocation was calculated using the chi-square test with a significance level of 5%.

In order to compare the VAS values between the two groups over time, a two-way analysis of variance (group compared over time) was employed considering time as a repeated measure. A significance level of 5% was used. The effect size based on mean values was analyzed using Cohen's d, where d = 0.2 represents a small effect, d = 0.5 a moderate effect, and d = 0.8 a large effect.[20] The proportion of headache frequency at all assessment times was described and compared within and between groups using, respectively, the Friedman test and the Mann-Whitney *U* test with a 5% significance level. All the groups were evaluated according to an intention-to-treat analysis. Missing data originating from dropouts were excluded from the final analysis.

Results

The baseline demographic and clinical characteristics of all participants are described in Table 1. At baseline, the headache intensity was considered moderate to severe with a mean (± SD) of 6.9 (± 2.0) for group 1 and 6.5 (± 1.8) for group 2. Chronic headache was more prevalent in group 1, frequent headache in group 2, and tension-type headache (TTH) phenotype was prevalent in both groups, though the randomization process assured that between-group dissimilarities were caused by chance ($P > .05$).

Table 2 describes the characteristics of headache attributed to TMD that were recorded from the 27 patients who had at least a 50% reduction in headache intensity or frequency after 5 months of treatment (10 participants in group 1 and 17 participants in group 2). Fifty-five percent of the patients (95% CI, 35% ± 74%) suffered from headache for ≥ 15 days per month. In 66% the headache lasted for ≥ 4 hours per day, in 92% the headache had a bilateral frontotemporal location, and in 70% the headache had a pressing/tightening quality. More than half of the participants had associated symptoms.

A total of 41 subjects (17 in group 1 and 24 in group 2) were included in the final analysis. Management effects of masticatory myofascial pain on headache intensity and frequency are described in Figs 2 and 3. There was a significant reduction in headache intensity for both groups between baseline and the 2-month ($P < .001$) as well as the 5-month follow-up ($P < .001$). For group 1, the mean (± SD) baseline value decreased from 7.6 (± 2.2) to 4.4 (± 2.5) at the 2-month follow-up and to 3.1 (± 2.2) at the final follow-up. The corresponding values for group 2 were 6.5 (± 1.6) at baseline, 3.4 (± 2.2) at 2 months, and 2.5 (± 2.3) at 5 months. At both follow-ups, the intensity decrease was statistically significant only with respect to baseline ($P < .001$), but not between the 2-month and the 5-month follow-ups ($P > .05$). The Cohen's d indicated a large treatment effect, as the d values ranged between 1.3 and 1.9.

Neither the headache intensity nor the proportion of remission differed significantly between the two groups at any follow-up ($P > .05$). However, patients with the TTH phenotype at baseline presented a higher proportion of remission than those with a migraine phenotype ($P = .01$).

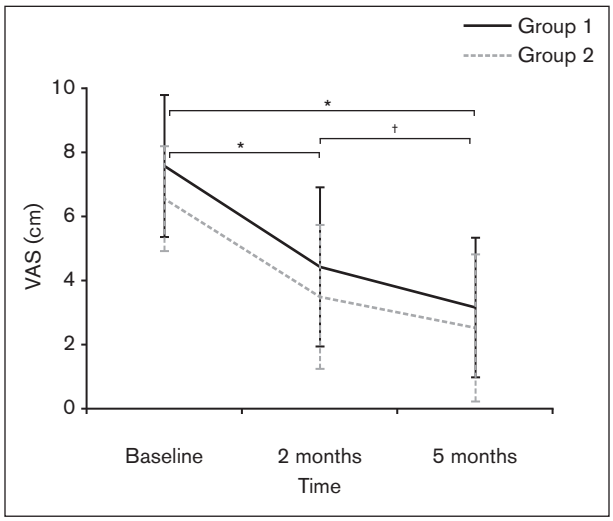

Fig 2 Line chart indicating the management effects on headache intensity (VAS = visual analog scale) versus all assessment times. Bars represent ± standard deviation of the mean. There was no significant difference between groups ($P > .05$). Within-group differences: * = $P < .001$; † = $P > .05$.

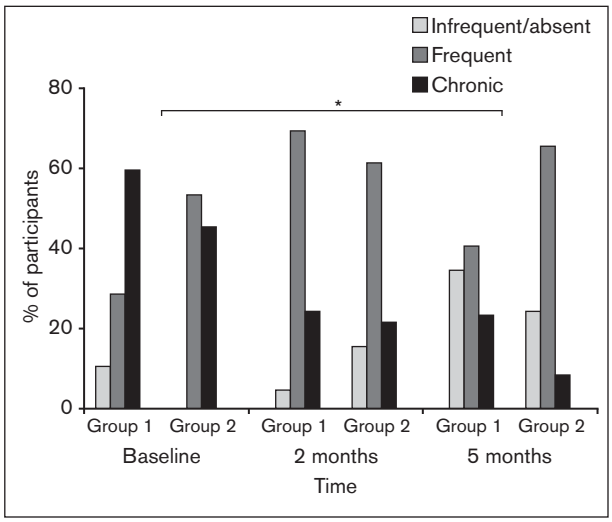

Fig 3 Column chart indicating the management effects on headache frequency versus all assessment times. Frequency was defined according to International Classification of Headache Disorders, 2nd edition (ICHD 2) as absent (no headache), infrequent (less than 1 day per month on average), frequent (1 to 14 days per month on average), and chronic (15 days or more per month on average). There was no significant difference between groups ($P > .05$). Within-group differences: * = $P = .01$ (Group 1); $P = .001$ (Group 2).

Headache frequency decreased significantly between baseline and the 5-month follow-up in both groups (group 1, $P = .01$; group 2, $P = .001$) but the decrease did not differ between the groups ($P > .05$).

Discussion

This study aimed to describe the clinical presentation of headache attributed to masticatory myofascial pain and to assess differences in headache improvement with the use of two strategies used to treat TMD. Briefly, the main findings were as follows: First, in the majority of participants, the headaches attributed to masticatory myofascial pain were characterized by a long duration (≥ 4 hours per day) and frontotemporal bilateral localization, and were associated with a pressing/tightening sensation. Second, the use of an occlusal appliance did not enhance the therapeutic effect obtained by counseling for habits and behavioral changes in the management of headache intensity and frequency.

The intensity and/or frequency of headache attributed to masticatory myofascial pain decreased with the use of successful management strategies that have been recommended by headache clinical trials.[21] This improvement was obtained using strategies primarily used for the management of TMD. It is important to note that occlusal appliances are not recognized as an option for treatment of primary headaches.[22] Taken together, these findings suggest that the headaches of patients that improved by at least 50% in intensity and/or frequency were secondary to masticatory myofascial pain. However, it must be pointed out that these characteristics are not "new" criteria for diagnosing headache attributed to myogenous TMD. Additional research is needed to determine the validity, reliability, and clinical relevance of this study's findings. Nevertheless, based on the findings, clinicians could suspect a headache secondary to myogenous TMD when, in the presence of signs of masticatory myofascial pain, the headache is of long duration and has a bilateral frontotemporal location. In the presence of these headache features, the clinician should examine the masticatory muscles in order to assess whether the patient suffers from headache attributed to myogenous TMD.

All participants were diagnosed with masticatory myofascial pain. It was decided to include only myogenous TMD because arthrogenous TMD has a low prevalence in subjects with headache, and muscular involvement is necessary for a significant association between TMD and headache.[8,9] The patients in both groups consisted mainly of women, which corresponds to the sex prevalence of TMD and headache patients.[23–25] The two groups did not differ as far as headache phenotype. Cross-sectional studies have reported a higher association between TTH and

TMD[26,27] or between migraine and TMD.[9,28] These differences could indicate a need for a more detailed evaluation of the type of headache in the presence of TMD.

Some studies have indicated that primary headaches and TMD are comorbid conditions based on the strength of the association and pathophysiologic similarities.[2,9] The present findings raise two questions: *(1)* What is the nature of the comorbidity? and *(2)* In the case of a comorbidity, is the headache primary or secondary? Comorbidity reflects the presence of one or more disorders or diseases in the same individual that can be etiologically independent or related. According to Rutter,[29] comorbidity *(1)* represents two manifestations of the same disorder, *(2)* reflects two stages of the same underlying condition, *(3)* arises from the same or correlated risk factors, *(4)* represents nosologically distinct conditions, and *(5)* is due to one condition predisposing to the other. Answers to the two questions above are difficult for several reasons. First, the possibility of a coexistence of primary and secondary headache in the same individual complicates the understanding of the relationship between TMD and headache. The knowledge of the characteristics of headache attributed to TMD could therefore help not only in elucidating this issue, but also in contributing to a correct diagnosis and appropriate treatment. Attempts have already been undertaken in this respect that lead to two new diagnostic criteria for headache attributed to TMD. Both the new ICHD 3–beta version[5] and the new Diagnostic Criteria for TMD (DC/TMD)[30] describe criteria for headache attributed to TMD. However, the clinical presentation of headache secondary to TMD remains unknown.[5,15]

A second problem that makes it difficult to differentiate between TMD, primary headache, and headache attributed to TMD is their similar pathophysiology and clinical characteristics. More specifically, migraine, TTH, and TMD may share much the same pain pathway, and all could be affected by peripheral and central sensitization processes.[31,32] For instance, TTH and TMD often have overlapping symptoms, eg, muscle tenderness,[30] and muscle alterations caused by TMD may play a role in the development of TTH.[33] Also, an increase in the frequency of TTH could be associated with more severe TMD pain.[34] Additionally, myogenous TMD may concur aggravating migraine. Indeed, migraineurs with TMD more often suffer from chronic migraine than migraineurs without TMD.[35] Therefore, pathophysiologic aspects provide at least a theoretical basis for a bidirectional cause-effect relationship.

In this study, participants with the TTH phenotype at baseline achieved greater improvement when compared to those with the migraine phenotype. This might be partially explained by an overlap of TTH and masticatory myofascial pain. However, it is important to note that nausea and/or vomiting, which are characteristic for migraine, were present in more than half of the patients.[30] Also, in spite of the findings that the characteristics of headache attributed to masticatory myofascial pain might resemble TTH (bilateral frontotemporal location and pressing/tightening), 21% of migraine patients can experience pressing pain bilaterally, which can be more common than a unilateral location of pressing pain, particularly for high-frequency migraines.[36,37] Finally, mild nausea is commonly present in patients with frequent TTH.[5] Thus, taking into account all the headache characteristics, migraine or TTH could be attributed to TMD; so rather than describe primary headache phenotypes for headaches attributed to TMD, it may be more suitable to recognize which headache characteristics are related to TMD.

There is some evidence that in patients with masticatory myofascial pain and headache, occlusal appliance therapy leads also to an improvement of the headache in the short-term and long-term; this improvement has been shown to range from 30% to 50% at 12 months.[11,12] The results of the present study suggest that an improvement in masticatory myofascial pain–related headache can be achieved simply by counseling, eg, without the use of an occlusal appliance. Indeed, the headache improved equally with or without an occlusal appliance with a great effect size. That said, the use of an occlusal appliance could contribute to greater adherence to treatment, as some participants of group 1 dropped out of the study. On the other hand, these results confirm the findings of previous studies that have shown that counseling for behavioral changes is effective in the management of masticatory myofascial pain.[38–41]

The present study's strengths included the use of the criteria for secondary headache described in the new ICHD 3–beta version[5] and the use of a control group for assessing the efficacy of an occlusal appliance. It is important to note that all participants whose headache appeared prior to masticatory myofascial pain and who did not have headache worsening after the appearance of the pain were excluded.

The study had three major limitations. The first was the difficulty in determining the chronologic order of appearance of the masticatory myofascial pain symptomatology and headache, eg, to assess whether the headache really appeared after the masticatory myofascial pain. However, this is a limitation inherent in the study design, as it was assumed retrospectively that the participants suffered from myogenous TMD. The second major limitation was the lack of a control group with headache without masticatory myofascial pain and without therapy. Thus, it is unclear

if the aforementioned characteristics are distinctive of headache attributed to TMD. Also, considering that the majority of participants still had at least mild headaches after the treatment, it is possible to suspect the presence of pre-existing primary headaches, and, therefore, it is not feasible to support any characteristic as sine qua non for headache attributed to TMD. It is also possible that the adopted management strategies improved "genuine" primary headaches. These questions remain to be considered and further analyzed in future studies with a proper design, eg, cohort studies with a nested RCT. Some of the headache improvement could also have been due to spontaneous remission, as this may occur in headache patients. In fact, the prognosis of primary headaches has been shown to be favorable, with remission rates of 45% for episodic TTH and 42% for migraine patients in a 12-year follow-up study of the general population.[42] The lack of a regular medication intake assessment is also a shortcoming, since the acute medication use could also have contributed to the headache improvement. Lastly, there were several withdrawals in group 1, which may have jeopardized the results as far as the comparison between the two treatment modalities, but not for the characterization of secondary headache.

Conclusions

In patients suffering from headache attributed to masticatory myofascial pain, the headache was frequently of long duration (≥ 4 hours/day) and had a bilateral frontotemporal localization and a pressing/tightening quality. Counseling for TMD was effective in improving headache, and the addition of an occlusal appliance did not offer any additional therapeutic effect.

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Erratum

In the article "Oral Health-Related Quality of Life in Patients with Temporomandibular Disorders," published in the summer issue (J Oral Facial Pain Headache 2015;29:231–241), the first and last names of the sixth and eighth authors were transposed. The authors' correct names (first name/last name) are **Avraham Hadad** and **Noam Yarom**.