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ORIGINAL RESEARCH

Occurrence of Malocclusion in Patients with Orofacial Pain and Temporomandibular Disorders

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ABSTRACT

Aim: This study aims to investigate the occurrence of malocclusion in patients with orofacial pain and temporomandibular disorders (TMDs).

Materials and methods: A total of 437 standard orthodontic screening forms at a craniofacial pain TMD center were utilized to collect the data for this retrospective study. In addition to patient's demographics and Angle's molar classification, the following data were collected: Overjet (OJ), overbite (OB), mandibular range of motion, and whether or not there was a posterior crossbite or prior history of orthodontic therapy. Analysis of variance (ANOVA) and chi-square tests were then used to detect any statistical significant difference of the secondary variables' distribution among the three malocclusion groups.

Results: The majority of the studied population sample had a class I molar relationship (70.9%), followed by class II (21.1%) and class III molar relationship (8%). Overjet and OB were significantly increased for class II molar relationship group ($p < 0.001$), where no statistical differences could be identified for the mandibular range of motion between the groups. The prevalence of right and left posterior crossbite was about 12% for both, and most of the crossbites presented within class I molar group.

Conclusion: Class I followed by class II molar relationships were found to be the most occurring relationship in the studied population. Posterior crossbite presented in 12% of cases and mostly affected subjects with class I molar relationship.

Clinical significance: These findings would aid in recognizing the studied population's orthodontic presentation and support the assessment of their transverse interventional needs.

Keywords: Disorders, Malocclusion, Orofacial, Prevalence, Temporomandibular.

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INTRODUCTION

Many orofacial pain conditions can be associated with diffuse, nonspecific, or referred pain symptoms.[1] A thorough collection of clinical history leads to properly classifying orofacial pain cases into physical conditions (somatic and neuropathic) and psychological conditions.[2] Somatic pain is the most common category of pain seen in the dental office and can be musculoskeletal (muscle and joints) or visceral (vascular or mucosal) in nature.[3] Specifically, pain affecting the head, neck, and face regions are mostly of musculoskeletal origin.[4]

Over the past century, different etiological factors were proposed as the cause of TMDs and orofacial pain. Structural theories were among the earliest proposed as a causative factor. By the beginning of the twentieth century, Angle[5] had described what he thought was normal occlusion and the criteria for abnormal occlusion and implied that such structural changes may produce pathology. These principles of normal occlusion were refined with the introduction of the concept of centric relation.[6]

That was evolved later on in many more elaborated hypothesis such as disk displacement model of TMDs.[7] And further associations were studied including injury or trauma,[8] polyarthritic disease,[9] generalized joint hypermobility,[10] and bruxism.[11,12]

Recent studies using electromyography (EMG) have demonstrated increased EMG activity of some head and neck muscles in patients with myogenous facial pain.[13]

Mesial canine relation was shown to correlate with facial pain symptoms at population level.[14] Furthermore, facial and neck pain was associated with TMDs, distal occlusion, and certain occlusal features.[15]

Malocclusion was also investigated as an associated factor with the development of TMDs. Many studies showed a higher prevalence of TMD in class II malocclusion. Sonnesen et al[16] examined 104 children using Helkimo's index and muscle palpation. They found that class II malocclusion was the most prevalent malocclusion in their sample and was associated with TMDs. However, in one large sample study composed of 4,724 children, class III malocclusion was shown to be more prevalent.[17] Also, it was shown that open bite, crossbite, and increased OJ were associated with TMD signs.[18]

In regard to transverse occlusal findings in TMD patients, it was noted that upon the presence of unilateral posterior crossbite, an accompanying midline shift to the crossbite side may occur.[19] Thus, the literature proposed that unilateral crossbite and midline deviation are associated with TMDs.[16] In a systematic review by Thilander and Bjerklin,[20] it has been found that functional posterior crossbite with midline deviation is associated with headache, TMDs, muscular pain, and clicking. It has also been reported that the presence of signs and symptoms of TMD interferes with proper mastication and muscle strength in children.[21] It was also demonstrated that midline deviation is a characteristic of patients with TMDs.[22] In some cases, condylar trauma may reflect the same findings. It was reported that one fourth of subcondylar fractures cause mandibular shift, leading to class II malocclusion and midline shift.[23]

The literature has previously highlighted many common occlusal features associated with orofacial pain and TMDs. Although there are some agreements on specific occlusal criteria, posterior sagittal relationship was reported differently. The published malocclusion variability commonly associated with orofacial pain might be due to the utilization of nonrepresentative sample of the whole domain of orofacial clinical presentation. The present study targeted the analysis of occlusal features in subjects seeking treatment for orofacial pain and TMDs in a specialized center that is directed solely toward such special care. Therefore, the study aims to investigate the malocclusion occurrence in patients with orofacial pain and TMDs.

MATERIALS AND METHODS

Materials

The standard orthodontic screening form at a craniofacial pain center was utilized to collect the data for this cross-sectional retrospective study. After reviewing an available random sample of 442 patients' medical records, a total of 437 completed forms were collected for conduction of the study. That sample size enables statistical analysis of 98% power with a 0.05 level of significance with an estimated 60% of class I distribution, based on a prior published study.[24]

Medical records were selected at random where the first 17 records of each 26 alphabetically organized records' groups were chosen. The records analyzed include clinical data completed during the period from 2000 till 2010, and only subjects with incomplete orthodontic screening forms were excluded.

All records included belonged to subjects who presented with variable orofacial pain and TMD signs and symptoms in head and neck regions. These symptoms ranged in severity from mild chronic to severe acute presentations and have variable influence of somatic, neuropathic, and psychological etiological factors.

Orthodontic examination forms include the following data: age, gender, Angle's molar classification, OJ, OB, any history of previous orthodontic treatment, and findings on right and left posterior crossbite existence. The study was approved by the institution review board at Tufts University.

Methods

Malocclusion prevalence and sample demographics were calculated along with the associated variables' descriptive statistics. The data were then segregated into three subgroups per their molar classification (Class I, II, and III). Statistical Package for the Social Sciences (version 22.0) statistical software was used to apply ANOVA testing for any statistical significant difference of the continuous variables collected (OJ, OB, and ROM) among the three malocclusion groups. A contingency tables and chi-square test were also used to detect any statistical significant difference of posterior crossbite distribution among each malocclusion group. The level of significance was set at 0.05 ($\alpha = 0.05$).

RESULTS

A total of 437 medical records were reviewed and all indicated variables were collected. The majority of the sample was of female gender (82%), with a mean age of 41 years (±16.38) and age range of 10 to 88 years.

The majority of cases of the studied population were of class I classification (70.9%), followed by class II (21.1%) and class III molar relationship (8%), as shown in Table 1.

To further investigate the characteristics of occlusion, OJ and OB were assessed for each molar group. Tables 2 and 3 show the mean OJ and OB among each molar

Table 1: Occurrence of molar relationship among males and females within the studied sample of patients with orofacial pain and TMDs

			Molar relationship			
			I	*II*	*III*	*Total*
Sex	Male	Count	45	18	16	79
		% of total	57.0	22.8	20.3	100
	Female	Count	265	74	19	358
		% of total	74.0	20.7	5.3	100
Total		Count	310	92	35	437
		% of total	70.9	21.1	8.0	100.0

relationship group. The OJ and OB were significantly increased for class II molar relationship group.

On the contrary, no statistical significant differences were shown when the mean mandibular maximum opening and protrusion were compared among three molar relationship groups (p = 0.44 and 0.58 respectively, Table 4).

About 40% of sample had a prior orthodontic treatment, with the occurrence of both right and left posterior crossbite in 12% of the studied subjects. Most of the crossbites presented displayed statistical significant differences in its distribution. Class I group demonstrated most of crossbite occurrence in both sides (Tables 5 and 6).

DISCUSSION

The majority of the studied population in the current study was female. Supporting the common clinical observation, females have a higher prevalence of TMDs than males, a fact that was stated well in the literature as reported by Hatch et al,[25] Grosfeld et al[26] in Polish population, and studies from other Asian and Middle Eastern populations.[27,28] This was in relation to the reported smaller linear measurements of mandibular length, lower facial height, and total anterior facial height in female, in comparison to male subjects.[29] Other studies demonstrated further that females seeking treatment for TMDs had severe retrognathia.[30] These findings support the role of class II malocclusion in TMD population, being more prevalent in female subjects.

In the present study, the second most prevalent molar relationship (after class I) was class II. This is in agreement with previous studies highlighting the common nature of class II presentation in TMD young population.[16,18,31] Furthermore, a review of the literature related class II malocclusion to muscular problems.[32] This could be connected to alternation of occlusal functional relationship causing nonfunctional tooth contact, which is more frequently seen in patients with orofacial muscle pain.[33]

Table 2: Comparison of OJ means (mm), among the three groups of molar relationship using ANOVA, with f-value of 45.5, and p-value of <0.001

				95% confidence interval for mean			
Class	*n*	*Mean*	*Std. deviation*	*Lower bound*	*Upper bound*	*Minimum*	*Maximum*
I	310	2.14	1.113	2.02	2.27	0	6
II	92	2.82	1.511	2.51	3.14	1	7
III	35	0.54	1.039	0.19	0.90	–1	3
Total	437	2.16	1.318	2.03	2.28	–1	7

Table 3: Comparison of OB means (%), among the three group of molar relationship using ANOVA, with f-value of 33.1 and p-value of <0.001

				95% confidence interval for mean			
Class	*n*	*Mean*	*Standard deviation*	*Lower bound*	*Upper bound*	*Minimum*	*Maximum*
I	310	37.53	25.334	34.69	40.36	–20	110
II	92	52.18	35.038	44.93	59.44	–6	100
III	35	8.37	19.909	1.53	15.21	–20	60
Total	437	38.28	29.241	35.53	41.03	–20	110

Table 4: Mandibular maximum opening and protrusion means (mm) within the three molar relationship groups

Class	*n*	*Max open mean*	*Standard deviation*	*Protrusion mean*	*Standard deviation*
I	310	40.30	8.564	6.58	3.023
II	92	38.91	9.352	6.72	2.603
III	35	40.00	12.139	7.11	3.113
Total	437	39.98	9.057	6.65	2.944

Table 5: The distribution of right posterior crossbite presentation among molar relationship groups*

			Molar relationship			
			I	*II*	*III*	*Total*
Right crossbite	Absent	Count	280	83	23	386
		% of total	72.5	21.5	6.0	100
	Present	Count	30	9	12	51
		% of total	58.8	17.6	23.5	100
Total		Count	310	92	35	437
		% of total	70.9	21.1	8.0	100.0

*Pearson chi-square = 18.88 (p < 0.001)

Table 6: The distribution of left posterior crossbite presentation among molar relationship groups*

			Molar relationship			
			I	II	III	Total
Left crossbite	Absent	Count	284	77	24	385
		% of total	73.8	20.0	6.2	100
	Present	Count	26	15	11	52
		% of total	50.0	28.8	21.2	100
Total		Count	310	92	35	437
		% of total	70.9	21.1	8.0	100.0

*Pearson chi-square = 18.08 ($p < 0.001$)

Another contributing reason might be the forward head posture that was associated with class II occlusion.[34] Adopting such posture would further load suboccipital and neck musculature and express myogenic clinical symptoms.

Computed tomography (CT) studies found that anterior joint space was significantly wider in class II malocclusion subjects, with a deeper mandibular fossa.[35,36] Another CT study showed a general significant pattern of a more convex and anteriorly positioned condyles.[37] Thus, temporomandibular joint (TMJ) anatomy seems to be distinct in patients with class II malocclusion, subjecting such delicate orofacial structure to a more damage tendency.[38]

Class III malocclusion was shown to be the least occurring in the studied sample (8%). Sari et al[39] studied a group of TMD subjects and reported the same prevalence of class III molar relationship, and edge-to-edge anterior occlusion. The reduced mean OJ in the present class III group was only 0.54 mm, indicting a potential similar scenario of contributing orofacial symptoms occurring in class III molar relationship group to the edge-to-edge anterior occlusion previously reported. Cases with anterior crossbite and edge-to-edge anterior occlusion were shown to be a risk factor in developing TMJ symptoms.[40] It can trigger internal derangement onset as myofascial pain and TMDs are related to disk displacement in class III patients.[41] Such TMD cases with class III relationship are associated with skeletally increased SNB angle.[42]

Clinical signs of TMDs were strongly associated with increased OJ.[43] That increase was confirmed with anteroposterior radiographic study.[42] The current class II group had an OJ ranging from 1 to 7 mm with a mean (2.82 mm) that was significantly increased in comparison to other molar relationship groups. Overjet values currently presented matched earlier studies associating TMDs with OJ of more than 4 mm.[44,45]

The amount of OB was significantly the highest among molar class II relationship groups (52.18%). Deep bite could be associated in this group with orofacial pain as patients with deep bite more frequently reported jaw stiffness, muscle disorders, and increased somatization scores.[46] On the contrary, current class III group displayed the least mean of OB (8.37%), indicating a shallow bite with a lower range of –20%. Since many studies have indicated that anterior open bite is more prevalent with TMD symptoms,[17,45,47-49] current sample of orofacial pain subjects has illustrated this general finding specifically with class III molar group.

The mandibular range of motion measures were within normal. When the three molar classes were compared, neither the maximum opening value nor the mandibular protrusion range was significantly different. The mean maximum opening value was 40 mm, which is in agreement with the normal reported range of 42 mm.[50]

Studies that have investigated the role of malocclusion in the development of orofacial pain and TMDs have focused on three aspects: Malocclusion classification, coexisting occlusal characteristics (crossbite, horizontal/vertical overlap, and crowding), and the prevalence of prior orthodontic treatment. The current sample of orofacial population indicated that 40% of subjects had a prior orthodontic treatment. A sample of non-orofacial pain population has displayed similar occurrence of TMD symptoms in pre-orthodontic patients of 33.8%.[47] This supports the common agreement of the lack of direct relationship between orthodontic treatment and the onset of TMDs.[51,52]

Posterior crossbite was highlighted commonly as a finding in TMD population;[17,47] 12% of the current sample presented with crossbite that occurred mostly in class I group. From a clinical prospective, one of the causes of crossbite is local crowding. And subjects with teeth crowding were reported to have significant increased TMD signs of dysfunction.[53] The literature also illustrates how such transverse occlusal discrepancies would impact muscular condition and function. Jussila et al[54] demonstrated association between myalgia and lateral scissor bite.

Despite the reported occlusal characteristics associated with orofacial pain and TMDs, other studies indicated no such associations. Gesch et al[55,56] examined the signs and symptoms of TMDs and concluded that no single occlusal factors could be detected. Other studies reported similar findings of lack of association.[51,57,58]

The retrospective nature of the study shall be noted to appreciate the limitation of this finding. Nevertheless, the recent findings drawn from this specific population pool would contribute to the debate of malocclusion, orofacial pain, and TMD associations. And it would aid in the recognition of the studied population's orthodontic presentation and support the assessment of their transverse interventional needs. The current database shall provide an extended reference, as other studies continue to indicate no associations of TMDs with a specific malocclusion classification.[59-61] In addition, it would further stimulate investigating the laterality of transverse occlusal outcomes, such as crossbite.

CONCLUSION

The present retrospective study showed class I malocclusion to be the most occurring malocclusion, followed by class II, which was characterized by significantly increased OB and OJ. Posterior crossbite presented in 12% of cases and occurred most commonly in class I malocclusion group.

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