Original Article

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Correlation between temporomandibular disorders, occlusal factors and oral parafunction in undergraduate students

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Abstract

Aim: To investigate the prevalence of temporomandibular disorders (TMD) in undergraduate students and to correlate its prevalence with occlusal factors and parafunctional habits. **Methods:** 201 undergraduate students were evaluated. The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) was filled out at the beginning of the study, followed by occlusal analysis based on morphological and functional alterations. The identification of tooth grinding and clenching was carried out by self-reports. Statistical analysis was based on chi-square and multivariate logistic regression analyses. p-value for all statistical analysis was set at 5%. **Results:** According to RDC/TMD, 18.4% of subjects experienced myofascial pain (G-MPD), and 12.4% had joint disorder with disc displacement (G-DD). Tooth clenching was statistically associated with TMD (p=0.000). In the occlusal factors, overjet showed statistically significant correlation only with myofascial pain. No association between functional alteration and TMD was found. No statistically significant correlation was found between G-DD and occlusal alterations or parafunctional habits. **Conclusions:** Overjet and tooth clenching were correlated with G-MPD. Occlusal alterations or parafunctional habits did not show correlation with G-DD.

Keywords: myofascial pain syndromes; temporomandibular joint disorders; bruxism; dental occlusion.

Introduction

Epidemiological studies are performed to determine the prevalence of temporomandibular disorder (TMD) in various populations. Higher prevalence rates are observed in patients who have sought some sort of treatment, compared to non-patient populations[1]. However, diseases and disorders cannot be understood only by the study of people seeking treatment, but also by the expression of the disease in the population as a whole[2].

Currently, TMD can be considered the most frequent cause of chronic orofacial pain, and its most common symptoms are pain and/or tenderness in the preauricular region, cervical and masticatory muscles; restricted or deflection mandibular movements; and temporomandibular joint (TMJ) sounds[3-4]. This dysfunction has multifactorial etiology[5-6], and biomechanical, neuromuscular, biopsychosocial and neurobiological factors may contribute to the disorder[7]. These factors are classified as predisposing (structural, metabolic and/or psychological conditions), initiating

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(trauma or repetitive adverse loading of the masticatory system) and aggravating (parafunctional, hormonal or psychosocial factors) to emphasize their roles in the progression of TMD[8-9].

Studies have evaluated the important role of occlusal alteration in the etiology of TMJ disorders. Some results suggested that TMD was associated with posterior crossbite, anterior open bite, Angle class III malocclusion, extreme maxillary overjet, discrepancy between centric relation and maximal intercuspation position, interference on the nonworking side, absence of effective canine guidance and occlusal instability[5-6,10-12]. Although occlusion is commonly considered to be a major risk factor for TMD, there is limited understanding of the causal relationship between the occurrence of TMD symptoms and occlusion, and of the possible role of different aspects of occlusion in the etiology of TMD[13].

Parafunctional habits such as bruxism and tooth clenching might increase the risk of developing TMD[14-15]; when the adaptive capacity of the joint is exceeded[16]. Bruxism and clenching reportedly leads to joint space reduction, followed by disc compression and resulting pain in masticatory muscles[17].

Considering the multiplicity of symptoms of TMD, a standardized diagnostic system with proper intraoral and extraoral exams is required to assess risk factors and to identify conditions requiring prevention and treatment. For this purpose, classification systems have been proposed and used by many epidemiological studies. Thus, the introduction of an index called the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) aimed to standardize the diagnosis and classification of different clinical settings of TMD[18-19]. In this context, the aim of this study was to determine the prevalence of TMD in undergraduate students considered a non-patient population, to investigate a potential correlation among some occlusal factors and parafunctional habits, using the RDC/TMD as a diagnostic measure, based on a clinical exam. The tested hypothesis is that the etiology of dysfunction is related to occlusal variables and parafunctional habits.

Material and methods

The research protocol was approved with number 373/08 prior to study initiation. Two hundred and one undergraduate students between 17 and 34 years of age, from the same university and with a mean age of 20.5 years were enrolled.

Participants' selection and TMD diagnosis

All participants answered a questionnaire developed for this study, which contained the inclusion and exclusion criteria[11], and questions related to parafunctional habits. Subjects who had undergone previous occlusal adjustment, extracted teeth, except third molars and premolars for orthodontic reasons, or who wore occlusal splints in the last six months were excluded from this study. In addition, subjects with any history of severe facial trauma, relevant head and neck pathologies, systemic diseases, or drugs that may reflect muscle activity were not included in order to obtain a homogeneous sample with similar characteristics. All other students continued their participation in the research.

The identification of parafunctional habits was carried out by self-reports. The undergraduate students answered the following questions: 1- Are you aware of grinding and/or clenching your teeth? and 2- Have ever your parents, siblings or bed partners already heard grinding sounds? Later, medical history was reviewed and clinical examination was performed according to the RDC/TMD guidelines[18] using the validated Brazilian version of the RDC/TMD instrument available since 2010 on the RDC/TMD consortium web site[20]. All steps were undertaken by a single calibrated examiner.

In this study, only Axis I was considered, and this axis can be divided into three subgroups. For each person, this axis provides the score and obtains the single or combined RDC/TMD group diagnosis. The first subgroup (G-MPD) is related to myofascial pain disorder with or without limited opening; the second subgroup (G-DD) comprises disc displacement with reduction, disc displacement without reduction with limited opening, and disc displacement without reduction and without limited opening. Finally, the third subgroup comprises degenerative joint diseases (G-DJD) namely arthralgia, osteoarthritis and osteoarthrosis. Only the subgroups G-MPD and G-DD were considered in this study due to lack of complementary exams to validate the G-DJD diagnostic group.

Occlusal examination

Occlusal analysis was carried out without knowledge of the RDC/TMD results from each patient. Evaluation of occlusal alterations was carried out into two steps: the first a functional or dynamic analysis, verifying the discrepancy in position between the centric relation (CR) and maximal intercuspal position (MIP), occlusal interferences in lateral movements and protrusion. The second step was morphological or static analysis, based on measurements and observations of the morpho-skeletal characteristics, such as overjet (normal value <4 mm), overbite (normal value $> 0 < 5$ mm), anterior/ posterior open bite and anterior/posterior crossbite[11].

Discrepancy between jaw positioning in CR and MIP was observed using Lucia jig for muscle relaxation. After approximately five minutes of use, this device eliminates the reflex arc responsible for the acquired mandible closure trajectory in MIP, determined by memory traces and the teeth[21]. Subsequently, mandible manipulation (frontal technique) was used to identify the centric relation position until first contact between opposing teeth (premature contact) occurred. At this time, the teeth in contact were marked with a pencil registering the CR position. The maxillary tooth was used as a fixed reference point; subsequently, the subject was instructed to open and close the mouth in MIP. Thus, the mark present in the mandibular tooth enabled other demarcation in the maxillary arch in this new position. The distances between the maxillary markers were measured and reported as discrepancy between CR and MIP in the anterior-posterior direction.

Group function, mesiotrusion and laterotrusion interferences during lateral movements, and posterior interferences during protrusion were identified using the double-sided articulator film (Accufilm II® Parkell, Farmingdale, NY, USA). Discrepancy between CR and MIP ≥2 mm, mesiotrusion and laterotrusion interferences, posterior interference during protrusive movement, and mouth opening less than 40 mm were also considered functional alterations.

Statistical analysis

The statistical analysis was performed using the Statistical Package for Social Sciences 15.0 (SPSS, Inc., Chicago, IL, USA). The chi-square (X2) test and Multivariate Logistic Regression Analysis were used. In X2 test, each variable was tested individually to find some kind of dependence on the diagnostic groups. Self-reported parafunctional habits by participants were also included in the statistics to identify any correlation. Two multivariate logistic regression models were created (G-MPD and G-DD) to identify significant associations with occlusal factors and parafunctional habits. In this analysis, all variables were tested simultaneously for each group, promoting an inter-relationship between them and simulating the standard multifactorial etiology of TMD. The tested hypothesis was accepted when $p<0.05$.

Results

Among the 201 subjects, 146 (72.6%) were women and 55 (27.4%) were men. According to the diagnoses obtained by the RDC/TMD, 18.4% participants (30 women and 7 men) were in G-MPD, and 12.4% (22 women and 3 men) in G-DD. All disc displacement cases were with reduction (Table 1). Analysis of the results by the X^2 test revealed no statistically significant difference between gender and prevalence of both disorders ($p=0.141$).

Tooth clenching was reported by 85 participants (42.3%), and 26 of them were classified in G-MPD and 13 in G-DD. Tooth grinding was reported by only 26 subjects (12.9%), 7 classified in G-MPD and 6 in G-DD. According to the chi-square test, only tooth clenching showed statistically significant correlation with G-MPD ($p=0.000$) (Table 1).

The X2 test did not show any statistically significant association between occlusal alterations and dysfunction groups (Tables 2 and 3). In the logistic regression model related to G-MPD, only tooth clenching and overjet showed some degree of correlation with myofascial pain (Table 4). The model presented $R^2=0.108$. The logistic regression model related to G-DD did not show any statistically significant association with occlusal alterations or parafunctional habits.

Discussion

The hypothesis that the etiology of dysfunction is related to occlusal factors and parafunctional habits was partially confirmed. Overjet and tooth clenching showed statistically significant correlation with myofascial pain.

The basic premise of the population's perspective is that diseases and disorders cannot be understood exclusively by the study of persons seeking treatment. Rather, to understand a disease, one must understand the expression of the disease in the population as a whole. Clinical samples reflect not only the manifestations of the disease itself, but also all the biological, psychological and social factors associated with an individual's motivation to seek care and with access to

Table 1. Contingency table between variables: parafunctional habits (grinding and clenching teeth) and TMD diagnosis (G-MPD and G-DD) (n total = 201, % total = 100)

	Diagnostic G-MPD						Diagnostic G-DD					
	Positive (n=37)		Negative (n=164)		X^2	p-value	Positive (n=25)		Negative (n=176)		X^2	p-value
	n	%	*n*	%			*n*	%	*n*	%		
Tooth Clenching					14.548	0.000					1.103	0.202
Yes	26	12.9	59	29.4	-	-	13	6.5	72	35.8	-	-
No	11	5.5	105	52.2	-	-	12	6	104	51.7	-	-
Tooth Grinding					1.442	0.174					0.022	0.590
Yes	7	3.5	19	9.5	-	-	6	1.5	20	11.4	-	-
No	30	14.9	145	72.1	-	-	19	10.9	156	76.1	-	-

Table 2. Contingency table between occlusal morphological alteration and TMD diagnosis (G-MPD and G-DD) (n total = 201, % total = 100)

	Diagnostic G-MPD						Diagnostic G-DD					
	Positive (n=37)		Negative (n=164)		X^2	p-value	Positive (n=25)		Negative (n=176)		X^2	p-value
	n	%	n	%			n	%	n	%		
Overjet					5.577	0.075					0.499	0.868
0mm	0	0	5	2.5	-	-	1	0.5	4	2	-	-
< 4mm	32	15.9	152	75.6	-	-	22	10.9	162	80.6	-	-
= 4 mm	5	2.5	7	3.5	-	-	2	1	10	5	-	-
Overbite					0.265	0.891					1.243	0.751
= 0mm	2	1	6	3	-	-	2	1	6	3	-	-
> 0 < 5mm	33	16.4	150	74.6	-	-	22	10.9	161	80.1	-	-
= 5 mm	2	1	8	4	-	-	1	0.5	9	4.5	-	-
Anterior open bite					0.085	0.559					0.287	0.501
Yes	2	1	11	5.5	-	-	1	0.5	12	6	-	-
No	35	17.4	153	76.1	-	-	24	11.9	164	81.6	-	-
Posterior open bite					0.456	0.665					2.617	0.234
Yes	0	0	2	1	-	-	1	0.5	1	0.5	-	-
No	37	18.4	162	80.6	-	-	24	11.9	175	87.1	-	-
Anterior crossbite					0.687	0.541					1.221	0.330
Yes	0	0	3	1.5	-	-	1	0.5	2	1	-	-
No	37	18.4	161	80.1	-	-	24	11.9	174	86.6	-	-
Posterior crossbite					0.000	0.672					1.653	0.223
Yes	2	1	9	4.5	-	-	0	0	11	5.5	-	-
No	35	17.4	155	77.1	-	-	25	12.4	165	82.1	-	-

Table 3. Contingency table between occlusal functional alteration and TMD diagnosis (G-MPD and G-DD) (n total = 201, % total = 100)

	Diagnostic G-MPD						Diagnostic G-DD					
	Positive (n=37)		Negative (n=164)		X^2	p-value	Positive (n=25)		Negative (n=176)		X^2	p-value
	n	%	n	%			n	%	n	%		
Discrepancy CR and MIP					0.182	0.456					0.617	0.337
< 2mm	26	16.4	142	70.6	-	-	23	11.4	152	75.6	-	-
= 2mm	11	2	22	10.9	-	-	2	1	24	11.9	-	-
Laterotrusion interference					0.51	0.481					0.160	0.424
Yes	17	8.5	72	35.8	-	-	12	6	77	38.3	-	-
No	20	10	92	45.8	-	-	13	6.5	99	49.3	-	-
Mesiotrusion interference					0.601	0.276					0.704	0.265
Yes	17	8.5	68	31.8	-	-	12	6	69	34.3	-	-
No	20	10	96	49.8	-	-	13	6.5	107	53.2	-	-
Posterior Interferece												
Yes	7	3.5	40	19.9	-	-	4	2	43	21.4	-	-
No	30	14.9	124	61.7	-	-	21	10.4	133	66.2	-	-

Table 4. Variables remaining at the end of the multivariate logistic regression equation: G-MPD diagnosis positive *versus* negative

CI 95%					
	B	p-value	OR	Down	Up
Tooth clenching	1.444	0.000	4.236	1.931	9.294
Overjet	-1.348	0.029	0.206	0.078	0.869
Constant	0.810	0.345	2.248		

care[2]. Thus, to determine the prevalence of TMD in this study, a population of students as a non-patient population was assessed.

Among the studied subjects, 18.4% were diagnosed with myofascial pain and 12.4% with disc displacement with reduction. Muscle disorders group was the most frequent diagnosis and this value is moderately higher than those found in a prior study performed in non-patient populations[1]. It is possible that these small prevalence variations occur due to socioeconomic and cultural differences inherent to each population. However, it is puzzling that such a high number of undergraduate students did not seek treatment since it is an informed population with access to the health system. Although a general population perspective is that half of the cases of temporomandibular disorder pain have never sought treatment, and only one-quarter sought treatment in the past six months[22], it is worrisome that other Brazilian non-patient populations may present prevalence rates equal to or higher than these. More studies should be performed in Brazil so that new health policies can be introduced in the country.

In general, TMD occurs in populations over 18 years of age; it is primarily a condition of young and middle-aged adults, rather than of children or elderly, and it is approximately twice as common in women as in men[2]. This study in an adult population between 17 and 34 years did not observe statistically significant correlation between gender and TMD, but a female predominance was observed in G-MPD and G-DD. The higher prevalence rates for adult women than for adult men may indicate that biologic, behavioral, psychological, and/or social factors associated with female gender increase the risk of experiencing pain in the temporomandibular region[2].

A significant association between tooth clenching and G-MPD was observed. This probably can be explained by the association of muscle tension in the jaw, face, head or a combination of them. This is caused by parafunctional behavior, which is strongly related to levels of jaw and facial pain[23]. Repetitive strain injury to the muscle, resulting from parafunctional activities such as teeth clenching or grinding may cause pain in the masticatory muscles by the induction of localized tissue ischaemia and/or release of algogenic substances such as serotonin or glutamate to excite and sensitize muscle nociceptors[16]. It is possible that the longer the clenching habit the more likely the development of TMD signs and symptoms.

No statistically significant correlation between tooth grinding and TMD was achieved, but this might be attributed to the low prevalence of this disorder in the studied population. Complete absence of correlation may have been neglected, because tooth grinding episodes act as microtraumas in the stomatognathic system, which can precipitate pain and system changes[4]. Further studies need to be carried out with methodologies specific to bruxism diagnosis[24]. The complete clinical examination to assess the impact of bruxism on oral structures is important because self-reporting participants may eventually over- or underestimate their tooth grinding and clenching habits[24].

As described in Tables 2 and 4, although overjet was not considered statistically significant in the X2 test, the logistic regression analysis revealed that this was the only morphological variable associated with G-MPD, confirming previous results[5-6,10,12]. Excessive overjet predisposes to large mandibular movements, most probably for functional reasons, speech articulation and bite, which may stress the masticatory muscles[6]. It is likely that the longer the clenching habit the more likely to develop signs and symptoms of TMD. Furthermore, recent study showed that large overjet or anterior open bite associated with clenching had a significantly higher prevalence of combined diagnoses, namely, disorders involving both the jaw muscles and the temporomandibular joints[25].

Functional occlusal alterations were more frequent than morphological alterations (Tables 2 and 3), but showed no statistically significant correlation with muscle or joint disorders. High frequency of these occlusal variables was also found among undergraduate students without TMD. Previous study asserts that it is difficult to determine associations between TMD and occlusion due to the high prevalence of occlusal interferences in the general population, so a standardized control group without occlusal disorders is not possible[26]. Sometimes the control group is also compromised by the inclusion of patients with mild symptoms or adaptation[27]. To minimize this difficulty, these authors suggest conducting studies among populations based on a control group with minimal symptoms and on an experimental group with maximum degree of the disease[27].

Multivariate logistic regression models were created to cluster the possible risk factors and presence of the disorder, considering its multifactorial character. Analyses of G-MPD and G-DD showed considerably low R^2 values, meaning that the model explains little about the results (Tables 4 and 5). This low value was due to the low-frequency manifestations of the disorder among the study subjects. Thus, even if the associations found are not considered strong, it is known that TMD is multifactorial in origin and the association of several factors determines their etiology. These factors are classified as predisposition (structural, metabolic and/or psychological conditions), initiation (trauma or repetitive adverse loading of the masticatory system), and aggravation (parafunctional, hormonal, and psychosocial factors)[8]. Thus, both stress and occlusal factors are required for development of this disorder, and occlusion is one of the causal factors[10]. Other biopsychosocial factors such as depression and somatization disorders should not be underestimated[28-30].

Due to its epidemiological nature, the study had to be conducted in a population composed by non-patients. However, one limitation of the study was its omission of a group of symptomatic patients to better fulfill the objective of determining correlations between occlusion variables, parafunctional habits and TMD. Therefore, further studies should be performed with representative samples of patients with bruxism and occlusal morphological changes, in comparison with standardized control groups. In addition, prospective longitudinal studies should be conducted to observe fluctuation in the lifelong signs and symptoms of TMD, and the incidence and remission of cases of parafunctional habits. The follow-up of patients with occlusal changes that are currently asymptomatic should also be the focus of longitudinal studies, in order to determine the effects of these variations in the long term.

In conclusion, only overjet and tooth clenching were correlated with myofascial pain. No occlusal alterations or parafunctional habits showed correlation with disc displacement with reduction.

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