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Frequency distribution of temporomandibular disorders according to occlusal factors: A cross-sectional study

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ABSTRACT

Background: Temporomandibular disorder (TMD) is a common condition affecting the temporomandibular joint and causes pain and discomfort. However, the role of factors contributing to this problem is still controversial. The purpose of this cross-sectional study was to determine the correlation of occlusal factors and parafunctional habits with TMD and The determination of TMD prevalence among patients referring to Isfahan Dental School in 2017.

Materials and Methods: In this cross-sectional study, A total of 200 patients between 20 and 50 years were examined and questioned based on the Research Diagnostic Criteria for Temporomandibular Disorders assessment instrument. The association of occlusal factors (dental relationship, lateral occlusal scheme, horizontal differences between centric occlusion and Maximum intercuspation (MI), difference between MI and mandibular resting position) and parafunctional habits (bruxism/clenching and habits) with TMD was analyzed using Chi-square tests and independent sample *t*-test ($\alpha = 0.05$). Binomial logistic regression analysis was performed with respect to confounding variables.

Results: The prevalence of TMD in the studied sample was 58.9%. Only bruxism showed a significant difference between TMD and non-TMD groups ($P < 0.05$). Other parafunctional and occlusal factors did not act as influential factors for TMD.

Conclusion: Parafunction may play an important role in the initiation of TMD, although other habits and occlusal factors are considered as noninfluential factors. However, larger sample size and multicenter sampling are recommended for the future studies.

Key Words: Occlusion, prevalence, temporomandibular joint disorders

INTRODUCTION

According to the glossary of prosthodontic terms, temporomandibular joint disorder (TMD) is defined as a condition producing abnormal, incomplete or impaired function of the temporomandibular joint.[1]

Prevalence studies are needed in different populations and may show different values based on social, environmental, economic, and other specific factors related to every individual population. Furthermore, these kinds of studies can be conducted to keep track of changes in one individual population over time, because of changes in populations happen over time and changes of associated factors toward our investigated subject (here TMD) can occur. The

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importance of the epidemiology of TMDs is due to its complex etiology, wide age range of manifestations, and the knowledge that its treatment requires multiple diagnostic methods and therapeutic approaches to completely alleviate its signs and symptoms.[2] The prevalence of TMD is different among populations. It also depends on the patient's age, diagnosis methods, clinical situation, and type of study.[3-7]

TMD prevalence has been reported in many studies and ranged from 0% to 93% in clinical findings and 6%–93% based on questionnaires filled by patients.[6]

The etiology of TMD is multifactorial. Psychological factors,[5,8] malocclusion,[7,8] oral parafunction,[9] oral habits,[10] and trauma[7] are the most important factors associated with TMD. However, their effectiveness is still unknown.[11]

The influence of occlusion disharmony on TMD has long been debated. At first, occlusal factors were considered as important factors leading to TMD.[12] Recently, the role of occlusion on TMD occurrence has become questionable. Some studies also confirmed a significant relationship between posterior crossbite,[13] decreased overbite,[14] tooth loss,[15] and premature contact.[16] However, only a few studies have indicated a correlation between TMD and occlusal factors.[17-19]

Signs and symptoms of TMD have also been controversial. Different nonstandardized questionnaires were used to diagnose TMD for years.[19] As a result, a new research diagnostic criteria for TMD, Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), consisted of standardized clinical assessment of TMD signs, was proposed.[20] These criteria are revised periodically, and the most recent version is called Diagnostic Criteria for Temporomandibular Diseases (DC/TMD).

TMD can cause chronic pain and depression for a long time and has also been associated with headache.[21] As a result, diagnosis and early treatment planning is important and can significantly affect patients' quality of life.

The aim of this study was to determine the prevalence of TMD in patients referring to the Faculty of Isfahan University of Medical Sciences in 2017 and to determine the role of different occlusal and demographic factors in the etiology of TMD based on DC/TMD criteria. The null hypothesis was, that, there is no correlation between occlusal factors and also parafunctional habits with TMD.

MATERIALS AND METHODS

This cross-sectional study examined TMD prevalence and correlation between TMD and occlusal interferences. Over 6 months, patients between 20 and 50 years referring to the screening Department of Isfahan Dental School were questioned and examined by simple random sampling. The sample size for this study calculated by power analysis was 200 using the significance level of α (1.96 at the 0.05 significance).

Patients with complete edentulism, full mouth reconstruction with implant and with the history of orthodontic and orthognathic surgery were excluded.

This study was approved by the Research of Isfahan University of Medical Sciences under process number IR.MUI.RESEARCH.REC.1398.075. Informed consent for all participants was taken. A questionnaire consisting of two parts was completed by one examiner. The questionnaire was based on DC/TMD. The validity and reliability of the persian version of this questionnaire have been approved by Ahmadi Tehrani *et al*.[22] In the first part, the patient was asked about demographic factors such as age, gender, education, and habits such as bruxism, clenching, nail-biting, and lip biting. The second part included examinations of oral parafunctions, dental restorations, and occlusal factors as presumable contributing factors for TMD and investigation of TMD signs in each participant [Table 1]. The examinations were performed by a single-trained general dentist, who examined the same parameters according to a predetermined standard before the study. Calibration of the examiner was assured by model examinations, which were demonstrated and controlled by an experienced prosthodontist. With the

Table 1: List of investigated influencing factors on the temporomandibular disorder in the study

Demographic
Age
Gender
Education
Parafunction
Bruxism and clenching
Habits (nail biting and gum chewing)
Occlusal factors
Dental relationship (Class 1, Class 2, Class 3)
Lateral occlusion scheme (anterior guidance, canine guidance, partial group function, group function)
Horizontal differences between CO and MI
Difference between MI and mandibular resting position

CO: Centric occlusion; MI: Maximum intercuspation

discovery of one positive sign of Temporomandibular Joint disharmony in a patient, that participant was assigned to the TMD group. Based on the TMD basis of the TMD diagnosis, participants were divided into two groups: Group 1: Non-TMD group and Group 2: TMD group. Patients diagnosed with TMD were taken as the experimental group, and an equal number of age- and sex-matched participants were selected to serve as a control. For evaluating maximum intercuspation and centric occlusion distance (MI-CO difference) (CO is defined as the first tooth contact in centric relation [CR]) bilateral manipulation technique with a condensation silicone index (Speedex, Coltene, Switzerland) as an interocclusal recording medium was used. The distance >3 mm was considered clinically significant.[21] The difference between mandibular resting position and MI was measured by the estimation of the distance between two points on the patient's nose and chin by a digital caliper (ABSOLUTE Digimatic Caliper; Mitutoyo).

The statistical analysis was performed using statistical software (SPSS for Windows, 2009, Release 17.0; SPSS Inc., Chicago, IL, USA). The data were analyzed with the Chi-square tests to find the distribution of contributing factors of TMD and independent sample *t*-test for realizing mean and standard deviation of quantitative influencing factors. Multivariate analysis was performed using binomial logistic regression to assess the individual correlation of each variable on TMD. Statistical significance was based on $P < 0.05$.

RESULTS

In this cross-sectional study, 200 participants (72 men and 128 women) were examined. The mean age of patients was 35.03 ± 11.20 years.

TMD prevalence

The overall prevalence of TMD was 58.9% among study groups. Table 1 shows the frequency of TMD signs on both sides of the jaws. Deviation on opening and clicking were the most prevalent signs in TMD patients (25.2% on the right side and 33.2% on the left side for deviation and 9.6% on the right and 15.8% on the left side for clicking). These signs were significantly higher on the left side in comparison to the right side ($P < 0.001$). Other signs and symptoms related to muscles were not presented in a sufficient number of patients and as a result were not clinically significant. Maximum jaw opening of <35 mm was also considered as a limitation associated with TMD[23] and is reported to be 12.4% in the study group [Table 2].

Occlusal factors and parafunctional habits

Frequency distribution of different variables and their relation with TMD have been investigated in this study. Among different parafunctions, nail-biting and gum chewing did not show a significant correlation with TMD, but TMD-bruxism correlation was statistically significant ($P = 0.043$) [Table 3]. Occlusal parameters also did not show an influencing role in the occurrence of TMD and dental relationship, lateral occlusal scheme, and lack of posterior occlusal stop did not show a significant relationship with TMD. In independent sample *t*-test, horizontal differences between CO and MI and difference between MI and mandibular resting position were not significant in TMD and non-TMD groups and did not demonstrate an important role in TMD [Table 4].

Logistic regression of different contributing factors also showed significance only for bruxism (odds ratio [OR]: 6.00, $P < 0.05$) [Table 5], to be clinically noticeable, it should represent a doubling (OR, 2) or halving

Table 2: Frequency distribution of temporomandibular disorder signs (%)

TMD signs	Right (%)	Left (%)
Joint sound		
Click	9.6	15.8
Crepitus	3	2.5
Joint pain		
Spontaneous	2	1
On loading	0.5	2
Both	1	1
Mandibular deviation		
At opening	25.2	33.2
In protrusion	2.5	3
Both	2	2
Masseter tenderness		
Spontaneous	1.5	2
At pressure	2	1
Both	4.5	4
Temporalis tenderness		
Spontaneous	2	2.5
At pressure	1.5	2.5
Both	3.5	2
Medial pterygoid tenderness		
Spontaneous	1	1.5
At pressure	4	5.4
Both	4.5	4
Lateral pterygoid tenderness		
Spontaneous	0.5	1.5
At pressure	5	6.4
Both	5.4	4
Max opening		
<35	12.4	
≥35	86.6	

TMD: Temporomandibular disorders

(OR, 0.5) of risk, although the prevalence of disease and base risk must be taken into account for a final decision of clinical relevance. An OR of <1 indicates that the presence of the factor is associated with reduced risk, an OR >1 indicates increased risk.[24,25]

DISCUSSION

According to our study, TMD prevalence in cases with a range of 20–50 years (mean age: 35.03 ± 11.20) was found to be 58.9%. TMD prevalence has long been reported in various articles. Based on the participant's age group, study type, questionnaire or checklist characteristics, consideration of signs or symptoms in TMD diagnosis and region of research conduction, the number reported for prevalence differs. Based on the study results, the null hypothesis was partially accepted. The study showed no correlation between TMD and occlusal factors, but bruxism as a parafunctional habit correlated with TMD.

TMD symptoms have always been considered to demonstrate a broad prevalence peak between 20 and 40 years of age, with a lower prevalence in younger and older people. Recently, specific TMD conditions have shown distinct peaks in patient populations: One around the age of 30 years and another over the age of 50.[26]

In the study conducted by Muthukrishnan and Sekar in 2015,[27] patients were evaluated by the RDC/TMD protocol. According to this study, 53.7% of the Chennai population has shown one or more clinical

Table 3: Frequency distribution of different types of malocclusions and parafunctional habits (Chi-square test [%])

Mal/habit	TMD+ group	TMD −group	Total	*P*
Parafunction				
Bruxism	8.4	1.5	9.9	0.012*
Habits (nail biting and gum chewing)	16.8	7.4	24.3	0.087
Dental relationship				
Class 1	R: 34, L: 35.7	R: 23.9, L: 24.5	R: 56.9, L: 57.9	R: 0.24, L: 0.58
Class 2	R: 13.2, L: 13.3	R: 12.2, L: 12.2	R: 25.4, L: 25.5	
Class 3	R: 10.7, L: 7.1	R: 4.6, L: 3.6	R: 15.2, L: 10.7	
Lateral occlusion scheme				
Anterior guidance	R: 5.2, L: 6.7	R: 5.7, L: 6.2	R: 10.8, L: 12.8	R: 0.34, L: 0.64
Canine guidance	R: 29.4, L: 28.2	R: 22.7, L: 18.5	R: 52.1, L: 46.7	
Partial group function	R: 11.3, L: 12.3	R: 5.7, L: 6.7	R: 17, L: 19	
Group function	R: 11.9, L: 9.7	R: 6.2, L: 7.2	R: 18, L: 16.9	
Lack of posterior occlusal stop	R: 6.9, L: 9.4	R: 5, L: 5.9	R: 11.9, L: 15.3	R: 0.55, L: 0.46

*Significance. TMD+: With temporomandibular disorders; TMD−: Without temporomandibular disorders; R: Right side of the jaw; L: Left side of the jaw

Table 4: Mean and standard deviation of some occlusal factors in patients with and without the temporomandibular disorder (independent sample *t*-test [mm])

Parameter	Mean (SD)		*P*
	TMD+ group	TMD −group	
Horizontal differences between CO and MI	1.97 (1.26)	1.85 (1.03)	0.59
Difference between MI and mandibular resting position	0.57 (1.04)	0.5 (0.62)	0.54

TMD+: With temporomandibular disorders; TMD−: Without temporomandibular disorders; SD: Standard deviation; CO: Centric occlusion; MI: Maximum intercuspation

Table 5: Odds ratios and corresponding *P* - values of variables related to prevalence of temporomandibular disorder generated in binomial logistic regression analysis

Variables	Regression coefficient	Odds ratio	*P*	Confidence interval
Bruxism	1.659	5.254	0.043*	1.054-26.183
Habits (nail biting and gum chewing)	0.143	1.153	0.720	0.528-2.519
Dental relationship (Class 1, 2, 3)	R: 0.082, L: −0.068	R: 1.805, L: 0.934	R: 0.777, L: 0.815	R: 0.617-1.909, L: 0.525-1.659
Lateral occlusion scheme	R: 0.322, L: −0.154	R: 1.380, L: 0.857	R: 0.161, L: 0.488	R: 0.880-2.164, L: 0.555-1.324
Lack of posterior occlusal stop	R: 0.526, L: −0.673	R: 1.692, L: 0.510	R: 0.511, L: 0.374	R: 0353-8.108, L: 0.115-2.253

*Significance. TMD+: With temporomandibular disorders; TMD−: Without temporomandibular disorders; R: Right side of the jaw; L: Left side of the jaw

signs and symptoms of TMJ disharmony and as a result were assigned to the TMD group. In another study, using RDC/TMD protocol in the examination of students, the prevalence of TMD was calculated to be 17% of the population.[28]

In the present study, there was no significant difference between males and females. This is in contrast with the results of many other studies.[6,29-31] However, some studies declare that this sex difference is not present for all signs and symptoms of TMD and between all age groups.[27,32,33]

Any alteration in the normal conditions of the TMJs in our study put the patient into TMD group and even one sign or symptom was enough for this allocation. The most prevalent signs in the present study were found to be deviation of the mandible on opening (25.2% on the right side and 33.2% on the left side) and sound of clicking (9.6% on the right side and 15.8 at the left side). Maximum opening of <35 mm was present in 12.4% of the population as a manifestation of TMD. Pain and muscle tenderness showed lower prevalence in comparison with other factors. This order of signs is in agreement with Muthukrishnan and Gesch's studies,[27,34] which reported a higher prevalence of irregular jaw movements and joint sounds in comparison with other signs of TMD. Another interesting finding was that clicking and deviation on opening were significantly higher on the left side than on the right side, and this was in agreement with Troeltzsch *et al.*'s study.[21] This finding may be justified by considering the dominant chewing side of the study population.

In the current study, the history of bruxism and parafunctional habits was registered in the questionnaire. Only bruxism shows a significant correlation with TMD (P = 0.012) and lip and nail-biting were not considered as influential factors on TMD. Bruxism was the only variable that was correlated with subjective TMD symptoms considering OR of >2 as a threshold for clinical relevance as recommended. This is in agreement with some studies,[11,35] although several studies do not supprort such relationship.[36-40] In Magnusson *et al*. cohort study,[14] a group of 420 individuals was followed for 20 years, reporting a significant correlation between bruxism and TMD. The association between bruxism and TMD symptoms is based on the theory according to which the repeated overuse of TMJ determines functional abnormalities.[41] Bruxism is generally associated with muscle dysfunction and less associated with joint dysfunction, such as disc displacement. This parafunction may result in condylar bone remodeling and articular cartilage degradation and may contribute to the development of osteoarthritis of the TMJ.[42,43]

In this study, we concluded that a weak relationship is present between occlusal parameters such as type of dental relationship (Classes1, 2, 3), lateral occlusion scheme, horizontal differences between CO and MI, difference between MI and mandibular resting position, and TMD. These findings are in accordance with other studies.[21,34,44,45] Pullinger and Seligman[24] indicated a weak correlation between occlusion and temporomandibular disorders. They compared occlusal characteristics in patients with and without symptoms of TMD and concluded that malocclusion could act as a cofactor in the etiology of TMD and some occlusal features might be consequences of the disease rather than initiating factors. In the meta-analysis conducted by Koh and Robinson,[46] the authors concluded that occlusal adjustment may not have much influence on the treatment or prophylaxis of TMD. In another study, Badel *et al*.[47] found no difference between Angle's classes in patients with TMD and asymptomatic individuals. In the study conducted by Padala *et al*.,[48] the dental midlines were coincident at CR and CO in 75% asymptomatic individuals and in 50% symptomatic individuals, and the difference between TMD and non-TMD groups was statistically nonsignificant.[48] However, Weffort and de Fantini[49] reported that statistically significant differences between CR and MIC were quantifiable at the condylar level in symptomatic and asymptomatic individuals.

Number of patients and gathering of the sample from only one center were considered as limitations of this study. Study type also does not establish a cause and effect relationship. Randomized clinical trials with control groups and multicenter sampling are highly recommended for future studies. TMD affects patients' quality of life[50] and early diagnosis of TMD influences the prognosis of treatment.[51] As a result, knowledge of signs and symptoms and understanding of any contributing factor associated with TMD should be investigated more and in larger samples in the society, and all practitioners in the field of dentistry have to update their knowledge on this subject day by day.

CONCLUSION

Within the limitations of this study, the following conclusions may be drawn:

1. The prevalence of TMD based on the RDC/TMD protocol in patients between 20 and 50 years referring to Isfahan Dental School was 58.9%
2. Except for bruxism, none of the other parafunctional habits (nail biting and gum chewing) correlated with TMD
3. Occlusal factors investigated in this study (dental relationship, lateral occlusal scheme, horizontal differences between CO and MI, difference between MI and mandibular resting position) did not show any correlation with TMD signs and symptoms.

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Conflicts of interest
The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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