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Evaluation of the Relationship Between TMD Symptoms and Family History in Orthodontic patients and Controls

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Abstract

Aim: There is a controversy on the relationship between familial history, orthodontic treatment, and the onset or intensification of temporomandibular disorders (TMD). According to the high prevalence of TMD, the importance of its diagnosis, and the lack of sufficient information in determining the role of the familial traits in the inheritance of TMD symptoms, the present study aims to determine the relationship between familial history and TMD considering the orthodontic treatment.
Material and Method: The present case-control study was performed on 170 patients, aged over 14 years, referring to Shahid Beheshti Dental School and a private clinic. Patients with a history of head and neck trauma, history of orthognathic surgery, and systemic diseases were excluded.
Results: The prevalence of TMD was 47.1%, and clicking was the most frequently detected sign. The prevalence of TMD was 56.6% in patients with orthodontic treatment, 60% in patients with familial history, and 63.6% in patients with both orthodontic treatment and family history. TMD had a higher prevalence in women aged over 26 years, increased overbite, and in patients with parafunctional habits.
Conclusion: The present study demonstrated that the prevalence of TMD in patients with familial history was higher than those with no family history. Thus, orthodontic treatment should be considered an important environmental factor and family history as a risk factor for TMD in our treatments.

Keywords: Temporomandibular disorders (TMD), Family history, Orthodontic treatment

Background

Temporomandibular disorders (TMD) is a general term referring to several subjective and objective problems. Muscles of the masticatory system, the temporomandibular joint (TMJ), and dental relations are implicated in these disorders. TMDs are types of orofacial problems including temporomandibular joint (TMJ) pain, fatigue of the lower facial muscles (especially the masticatory muscles), limitation of mandibular movements, asymmetry of lateral movements, the presence of joint sounds (such as clicks), headaches, earaches, and occlusal disorders (1-3).

Several factors are involved in the etiology of TMJ problems, including traumatic injuries, immune system diseases, neoplasms, stress, occlusal interactions, loss or misalignment of teeth, disorders of the masticatory muscles or surrounding structures, internal or external changes in the structure of the TMJ, habits such as bruxism and clenching, or a combination of them (4, 5). Environmental factors such as parafunction, injuries, and stressful living conditions secondarily affect the interaction between phenotype and phenotype-induced risk factors. In addition, due to the multifactorial nature of TMD, many genetic variables contribute to the onset and persistence of painful TMD (6). However, the genetic etiology of

these disorders is not fully understood, requiring further studies, especially on genes involved in the progression of these disorders (7- 8).

On the other hand, a few valid studies have shown changes in TMD symptoms in patients with and without orthodontic treatment, and there is controversy in this regard (9-11). There is also disagreement about the relationship between orthognathic treatments (orthodontics and surgical treatment) and TMDs. Some articles have reported improvements or no change in symptoms (12-14), while others have recorded exacerbation of symptoms (15). A recent systematic review study claimed that the prevalence of TMD is high in people receiving orthodontic treatment in comparison with those not receiving these treatments (16). It can result from alterations in the condyle position in the joint and occlusion during the treatment process. Indeed, the findings indicated that orthodontics is not associated with an increased risk of TMD, representing the simultaneous occurrence of other psychological, parafunctional, genetic, and social factors in the potential risk for TMD symptoms during or after orthodontic treatment. Therefore, it is important to be aware of any orthodontic treatment to avoid further demands (17).

Considering the lack of investigations evaluating the role of family history and orthodontic treatment in TMD symptoms, the present study aims to determine whether family history and orthodontic treatments play a role in the development or exacerbation of TMD.

2. Methods

Study Population

A pilot study was designed to determine the sample size and the prevalence of TMD disorders, and the effect of family history. This descriptive study was performed on two groups of 20 patients undergoing orthodontic treatment and the control group. They were referred to Shahid Beheshti Dental School and private clinics. Participants were over 14 years and had no history of jaw surgery and trauma to the jaw, and systemic disease. According to the pilot study results, the sample size was calculated as n=85; eventually, 106 patients in the case group and 64 patients in the control group were enrolled in this study.

Study Design

Two questionnaires, including the one evaluating the signs and symptoms of TMD based on the Fonseca questionnaire, and the other in temporomandibular joint Textbook (18), were designed by two experts in orthodontics and prosthodontics. An expert Orthodontist evaluated intraoral and extraoral examinations according to the indicators of the book Okeson, which includes the maximum mouth opening, jaw deviation after joint rotation, pain in translation or rotation, pain when touching the front of the tragus, joint sound, pain when touching front and back of the ear and neck, occlusion classification, overjet and overbite rate, crossbite, dental wear and premature contact. TMD was diagnosed based on the below parameters: the maximum opening of the mouth in millimeters (minimum opening is 38 mm in women and 42mm in men); (18) mandibular deviation; pain in different areas of the face, head, and neck (assessed by examiner's touch and patients confirmation); joint sound (determined by touch and hearing). Also, to determine the effect of occlusion on increasing TMD, the type of occlusion, the amount of overjet and overbite (based on 3 criteria: low, normal, and high), the presence of anterior and posterior crossbite, the presence of premature contacts in lateral and protrusive movements and dental wears were examined.

Data Analysis

The Kolmogorov-Smirnov test was used to evaluate the normal distribution of data in studied groups. The obtained data were recorded in SPSS software version 25 and were statistically analyzed using the chi-square test. P-value <0.05 was considered significant.

3. Results

The normal values of the main study's data are presented in Table 1.

Table. 1. The results obtained Kolmogorov-Smirnov test in order to evaluate the normal distribution of values.

	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TMD	0.356	170	.000	0.635	170	.000
Orthodontic treatment	0.404	170	.000	0.614	170	.000
History of TMD and orthodontic treatment	0.514	170	.000	0.422	170	.000
a. Lilliefors Significance Correction						

The present study was performed on 170 patients, including 105 (61.8%) females and 65 (38.2%) males. The mean age of patients was 25.64 years (age range 14-60 years). Of these, 106 (62.6%) had orthodontic treatment, and 64 (37.4%) had no orthodontic treatment. Of patients with family history, 45% had not received orthodontic treatment, and 55% had received this treatment (P=0.470). None of these factors had a significant effect on orthodontic treatment. (Table 2)

Table. 2. General features of the patients in two groups

		Orthodontic treatment						
		No		Yes		Total		P- value
		N	%	N	%	N	%	
Age		64	37.6	106	62.4	170	100.0	0.152
	male	26	40.0%	39	60.0%	65	100.0	
Sex	Female	38	36.2%	67	63.8	105	100.0	
	Total	64	37.6	106	62.4	170	100.0	0.618
Family history	No	55	36.7	95	63.3	150	100.0	
	Yes	9	45.0	11	55.0	20	100.0	
	Total	64	37.6	106	62.4	170	100.0	0.470

- Data obtained by Pearson Chi-square test.

According to the clinical examinations, joint sound on touching the front of the tragus was only significantly different between the two groups (P<0.0001). Joint sound in the opening (77.8%), closing (74.5%), clicking (91.2%) was more common in people with orthodontic treatment. Moreover, patients with no joint sound were more in individuals who had not received orthodontic treatment (62.5%). Based on the Helkimo index, patients with more than 2 mm of deviation were considered as cases of TMD (43). In general, clicking is the most common symptom found among TMD patients. (Table 3)

Table 3. The results of clinical examination.

Variables		Orthodontic treatment				P value
		No		Yes		
		N	%	N	%	
Maximum mouth opening	30-40 mm	0	0.0%	4	100.0%	0.094
	40-50 mm	45	42.9%	60	57.1%	
	50-60 mm	19	31.1%	42	68.9%	
Joint pain on touching the front of the tragus	Yes	3	60.0%	2	40.0%	0.366[1]
	No	61	37.0%	104	63.0%	
Pain in the head and neck	In front of the ear	0.0	0.0%	4	100%	0.274
	Behind the ear	0.0	0.0%	0.0	0.0%	
	Neck	0.0	0.0%	0.0	0.0%	
	No	63	38.4%	101	61.6%	
Jaw deviation after joint rotation	Yes	3	21.4%	11	78.6%	0.191
	No	61	39.1%	95	60.9%	
Joint sound on touching the front of the tragus	In opening	2	22.2%	7	77.8%	<0.0001
	In closing	14	25.5%	41	74.5%	
	In both (reciprocal clicking)	3	8.8%	31	91.2%	
	No	45	62.5%	27	37.5%	

- Data obtained by Pearson Chi-square test.
1- Data obtained by Fisher's test.

According to Table 4, 62.4% and 37.6% had occlusion in patients with and without orthodontic treatment, respectively. Based on the type of occlusion, all of the patients with orthodontic treatment had CL I, CL II and CL III.

According to the results of the TMJ-related questionnaire, significant differences were recorded only in habits such as grinding or squeezing between the two groups (P<0.0001) as 96.1% of people with these habits had orthodontic treatment. The two groups had no significant differences based on other questions (Table 5).

Table 4. Type of occlusion in the patients of the study.

Type of occlusion	Orthodontic treatment				P*
	No		Yes		
	N	%	N	%	
CL I	35	45.5%	42	54.5%	
CL II	21	32.3%	44	67.7%	
CL III	7	38.9%	11	61.1%	
Cl I, II	1	20.0%	4	80.0%	
CL I, III	0	0.0%	5	100.0%	
Total	64	37.6%	106	62.4%	0.274

- Data obtained by Chi-square test

Table 5. The results of TMJ-related questionnaire.

			Orthodontic treatment				
			No		Yes		P value
No.	Questions	Answer	n	%	n	%	
1.	Do you feel pain or discomfort in front of or behind your ear when you open your mouth too much, for example when yawning?	No	56	38.6%	89	61.4%	0.342
		Sometimes	6	27.3%	16	72.7%	
		Yes	1	33.3%	2	66.7%	
2.	Do you have ear pain when chewing or talking?	No	62	38.5%	99	61.5%	0.611
		Sometimes	1	20.0%	4	80.0%	
		Yes	1	25.0%	3	75.0%	
3.	Have you ever heard sounds like a rattle in your ear when you open and close your mouth?	No	33	39.3%	51	60.7%	0.218
		Sometimes	27	40.9%	39	59.1%	
		Yes	4	20.0%	16	80.0%	
4.	Do you usually feel stiffness, dryness or tiredness in your jaws?	No	53	38.1%	86	61.9%	0.865
		Sometimes	10	37.0%	17	63.0%	
		Yes	1	25.0%	3	75.0%	
5.	Do you feel pain in your ears, temples or cheeks?	No	51	37.0%	87	63.0%	0.491
		Sometimes	10	47.6%	11	52.4%	
		Yes	3	27.3%	8	72.7%	
6.	Do you chew food easily?	No	62	39.0%	97	61.0%	0.613
		Yes	2	28.6%	5	71.4%	
7.	Do you have habits such as grinding or squeezing your teeth together?	No	28	57.1%	21	42.9%	<0.0001
		Sometimes	34	48.6%	36	51.4%	
		Yes	2	3.9%	49	96.1%	

- Data obtained by Chi-square test.

Statistical analyses showed that the relationship between TMD and overbite (P = 0.012) and overjet (P=0.001) was statistically significant. Although TMD prevalence in people with increased overjet is high, about 46.3% and 27.8% of people with increased overjet did not have TMD. 40% of people with increased over bite showed symptoms of TMD and 17.8% had no TMD. Decreased overbite and overjet were 10% (n=8) and 11.3% (n=9) in people with orthodontics treatment, respectively. Moreover, 31 (38.8%) and 37 (46.3%) patients with orthodontic treatment had normal overjet and overbite, respectively.

Moreover, TMDs were found in 80 (47.1%) of the patients in the study. Considering the history of patients with TMD symptoms, 46 (43.4%) people who received orthodontic treatment had significantly less TMD than the control group (P=0.001).

According to the questionnaire results, among the 20 patients with a history of TMD, 60% (n=12) showed symptoms of TMD, compared with 45.3% (68 out of 150), in patients without a family history of TMD. In other words, regardless of orthodontic treatment, the prevalence of TMD in patients with a family history is 15% higher than those without a family history.

Also, the prevalence of TMD was higher among women than men. 38.8% of men and 61.3% of women showed at least one of TMD symptoms. The prevalence of TMD in the age group >26 was higher than the other two groups (42.5%). It was also found that parafunctional habits can affect TMD. People with parafunctional habits are 59% (n=36) more likely to show symptoms of TMD (40.4% (n=44) without TMD ((P = 0.023). (Table 6)

The results of TMJ-related questionnaire

Table. 6. The results obtained from K-S test in order to evaluate the normal distribution of values.

		TMD						P value
		No		Yes		Total		
		N	%	N	%	N	%	
Family history	No	82	54.7	68	45.3	150	100.0	0.217
	Yes	8	40.0	12	60.0	20	100.0	
	Total	90	52.9	80	47.1	170	100.0	
Orthodontic treatment	No	44	68.8	20	31.3	64	100.0	0.001
	Yes	46	43.4	60	56.6	106	100.0	
	Total	90	52.9	80	47.1	170	100.0	
Gender	Male	34	37.8	31	38.8	90	100	0.896
	Female	56	62.2	49	61.3	80	100	
	Total	90	100	105	61.8	170	100	
Age	14-20	35	38.9	23	28.7	58	34.1	0.35
	20-26	24	26.7	23	28.7	47	27.6	
	26<	31	34.4	34	42.5	65	38.2	
	Total	90	100	80	100	170	100	
Parafunctional habits	No	65	59.6	25	40.9	90	52.1	0.023
	Yes	44	40.4	36	59.0	80	47.1	
	Total	10	100	61	100	170	100	
Overjet	Decreased	11	12.2	9	11.3	20	11.8	
	Increased	25	27.8	37	46.3	62	36.5	
	Normal	51	56.7	31	38.8	82	48.2	
	Open bite	3	3.3	3	3.8	6	3.5	
	Total	90	100	80	100	170	100	0.001
Overbite	Decreased	10	11.1	8	10.0	18	10.6	
	Increased	16	17.8	32	40.0	48	28.2	
	Normal	61	67.8	37	46.3	98	57.6	
	Open bite	3	3.3	3	3.8	6	3.5	
	Total	90	100	80	100	170	100	0.012

- Data obtained by Pearson Chi-square test.

Among people with no family history of TMD, the prevalence of TMD depends on the presence of orthodontic treatment as an environmental factor (55.8% of people with orthodontic treatment vs. 27.3% of people without orthodontic treatment) (P = 0.001). (Table 7)

Table. 7. The relationship between TMD and orthodontics treatment in patient without the history of TMD

		TMD						P value
		No		Yes		Total		
		N	%	N	%	N	%	
Orthodontics treatment	No	40	72.7	15	27.3	55	36.7	0.001
	Yes	42	44.2	53	55.8	95	63.3	
	Total	82	54.7	68	45.3	150	100.0	

- Data obtained by Fisher's test.

4. Discussion

TMDs are orofacial problems representing with pain and sound in the TMJ, fatigue of the lower facial muscles especially the masticatory muscles and limitation of mandibular movements. Despite the importance of TMDs, they are not realized in early stages and they become advanced and requires complex treatments. Early detection of these diseases can prevent its progression in the primary stages and reduces the costs associated with treatment (1-3). According to our results, at least one of the symptoms of temporomandibular disorders was seen in 47.1% of the subjects. The most common disorder observed was jaw sounds.

Similarly, in Rauch et al., (19) study, the highest reported symptom was joint sounds (31.9%). Moreover, in the study of Dervis (20) the prevalence of TMD among Turkish students was 47.53%, 33.95% of which were mild that is similar to our results. In 2019, Lodice et al., (21) found that the highest symptom of TMD was clicking, with 30.7% prevalence. Two recent cohort studies in Finland and Brazil indicated that the prevalence of TMD is 34.2% (22) and 34.9% (23), respectively. Furthermore, in another

investigation the prevalence of TMJ disorders in a group of Mexican adolescents and young adults was reported 46.1% (24). As shown, there are obvious differences in the prevalence of TMD disorders in various studies. These differences may be due to the variety of societies and patients' condition investigated in that studies. According to studies performed in Iran, Basafa and Shahabi evaluated the correlation between types of malocclusion TMJ disorders among students. The results showed that there were no significant correlation between malocclusion and TMJ discomfort among students. The highest level of correlation, which still was not statistically significant, existed between TMDs and CL II malocclusion. The correlation between TMJ discomfort and head, neck and back pain was significant (25). The aim of another study by Ebrahimi et al. was the epidemiologic evaluation of TMDs and related factors in a group of Iranian adolescents. They found that the prevalence of TMDs was 34.7%. The most common signs of TMDs were clicking, muscle tenderness and TMJ tenderness. The most prevalent predisposing factors of TMDs were clenching, premature contact in protrusive movement and bruxism (4). Jamalpour et al. investigated the frequency of TMD and its clinical manifestation in boxers of Islamic Republic of Iran national team. They showed that the most common symptom was ante-auricular pain followed by neck pain, right ante-auricular tenderness, muscle tenderness, neck tenderness and headache. The uppermost sign was right joint click followed by left joint click and jaw deviation during mouth opening (26). On the other hand, these differences can result from this fact that the term of "TMD" is largely ambiguous and its criteria are not completely clear and precise (27). In addition, the subjects in different studies were selected from various races, cultures and with different socio-economic conditions, which can also effect on the results (28). Based on our knowledge, this work is the first study that includes different age groups referring to the dental clinics, making them comparable to each other.

Our results also indicated that the prevalence of TMD was higher in the age >26 years which is similar to previous literature (29, 30). In addition, our data showed that the prevalence of TMDs in women is higher than men (61.3% vs. 38.8%), however this point should be noted that the number of women participating in this study was 23% higher than men. About 80% of people who had TMD treatment were women.

The present study also indicated that the prevalence of TMD among patients with orthodontic treatment and who did not receive orthodontic treatment was 43.9% and 30.2%, respectively. Similarly, few studies have suggested that the development of TMD symptoms in orthodontic patients may be due to changes in occlusion and joint position during treatment (16, 18), while many other investigations indicated that the association between orthodontic treatment is controversial or does not exist (9, 10, 17) .

We also indicated that about 60% of patients has a family history of TMDs in first or second relatives. The prevalence of TMDs reaches 63.6% when orthodontic treatment is considered. However, it should be noted that in general, orthodontic treatment, as an environmental factor, can have a high impact on the incidence of TMD. In other words, a person who has a family history of TMDs and undergoes orthodontic treatment is more likely to have symptoms of TMD than people without a family history. TMDs may be due to the low awareness of people about the family history of TMD in their 1st and 2nd degree relatives. In 2012, Plesh et al. (31), in a study of twins, concluded that TMJ pain could be inherited. A previous study by Matsuka et al. (32), have described the presence of family background as a probable predisposing factor. Also, studies on the genotype of individuals showed that the genetic factor in the occurrence of TMD pain was due to the presence of a specific gene encoding proteins that are expressed in response to painful stimuli and has been identified in the genome sequence of these individuals (33, 34). Study of Bonato et al. (35) supported the hypothesis that changes in the OPG and RANKL genes influence the presence of chronic joint pain in individuals with and without TMD. Additionally, the results of the study by Slade et al. (11), Showed that the risk of TMD in people with pain-sensitive haplotype was almost 3 times more than those people with pain-resistant haplotype.

Our evaluations about occlusion have shown that increased overbite may be associated with some degree of TMD. Although, Jussila et al. (36) concluded that the TMD signs were associated with unstable occlusion, especially the amount and lateral deviation in RCP-ICP (Retruded Contact Position and Intercuspal Contact Position) slide, as well as negative overjet. Moreover, a recent study examining different occlusal features in Italian students suggested that unilateral and bilateral crossbite and open bite may be associated with TMD pain (37). However, investigations did not find a statistical significant relationship between crossbite and TMD (38, 39). A recent systematic review showed a correlation between mediotrusive

interactions and TMD, however they were not statistically significant (40). Parafunctional habits are common among children and adults. The presence of these activities may have various effects on the orofacial structures. Balancing disturbances in the orofacial system can cause TMD or worsen pre-existing TMD symptoms (41). Our study in similar to other recent works confirmed the relationship between TMD pain and parafunction habits (37, 42-44). It should be noted that repetition of a parafunctional habit has a greater effect on TMD pain than other habits (37).

Due to the sensitivity and wide range of activities of the TMJ, there are several problems associated with joint health, so TMD disorders along with dental caries and periodontal disease should be considered as a major problem in the field of dentistry. On the other hand, today, due to the increasing desire of people for orthodontic treatment and the effect of this treatment on TMD symptoms, it should be explained to patients who did not have TMD symptoms before starting orthodontic treatment that TMD explosion can be due to their familial history. Also, at the beginning of treatment, the exacerbation of TMD symptoms should be considered in people who have a history of TMD themselves or in their family. On the other hand, since there are many differences in the methods and criteria for diagnosing TMDs and their validity, it seems that research for finding practical and valid methods for diagnosing various types of joint disorders is highly prioritized.

Conclusions

The present study showed that in patients with a family history of TMD, the prevalence of TMD was higher than those without a family history. Parafunctional habits affected TMD, and this relationship was also statistically significant. Additionally, TMD had the highest prevalence in women and those above 26 years. Also, TMD was more common in people with increased overjet and overbite. Overall, it was concluded that orthodontic treatment should be considered an important environmental factor and family history as a risk factor for TMD.

Limitations

The number of participants in this study was small. Patients' awareness of the presence of TMD family history was limited. Moreover, due to the outbreak of COVID-19, the collection of clinical samples was difficult.

Suggestion

Assessing the prevalence of TMD is recommended in relation to genetic etiology. Further epidemiological and multicenter studies should be conducted to investigate the relationship between TMD occurrence and familial history. Considering the limited studies evaluating the association between stress and TMD occurrence, further investigations are required.

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