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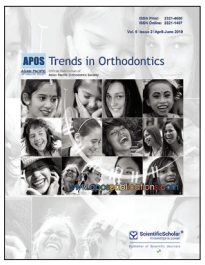

Original Article

The relationship of temporomandibular disorders with Class II malocclusion as a risk factor

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ABSTRACT

Objectives: The temporomandibular joints (TMJs) play a fundamental role in mastication, deglutition, speech, and even respiration. Thus, temporomandibular disorders (TMDs) can affect the quality of life, especially if they become chronic. Considering the controversy regarding the etiology of the TMDs, this study aimed to assess the relationship of TMDs with dental malocclusion.

Materials and Methods: Totally, 885 dentate patients between 18 years and 60 years with complete dental records and no condylar ankylosis, history of trauma, bruxism, clenching, or congenital TMJ anomalies participated in this study. Tenderness on palpation, clicking, crepitus, pain, deviation on mouth opening, open bite, deep bite, cross bite, and class of malocclusion (I, II or III) were recorded for all patients.

Results: Of patients, 60.2% were males and 39.8% were females. Gender had no correlation with TMDs. Patients had a mean age of 34.8 years. Age had no correlation with TMDs. Of TMD symptoms, clicking had the highest frequency (23.3%) followed by deviation on mouth opening (10.6%), pain at the mouth opening (2.9%), tenderness on palpation (1.4%), trismus (1.2%), and crepitus (1.1%). Of patients, 76.7% were Class I, 13.8% were Class II, and 6.2% were Class III. Less than 2% of patients had deep bite, open bite, or cross bite.

Conclusion: TMDs had a relatively high prevalence (35%) in our study population. Age, gender, and class of malocclusion had no correlation with TMDs; however, Class II malocclusion was slightly more prevalent among TMD patients, which needs to be taken into account by patients and orthodontists.

Keywords: Temporomandibular joint, Temporomandibular disorders, Occlusion, Open bite

INTRODUCTION

The temporomandibular joints (TMJs) play a fundamental role in mastication, deglutition, speech, and even respiration. Furthermore, TMJ is the only joint in the human body that is composed of two related symmetrical joints that operate in coordination.[1]

Temporomandibular disorders (TMDs) are diverse conditions caused by injury to the TMJs and are characterized by pain, masticatory muscle disorder, and TMJ dysfunction. Pain is the most important characteristic of TMDs, which is often associated with mandibular movement limitations, and TMJ sounds during the jaw movements. Clicking and crepitus are the most common joint sounds.[2] TMD is a multifactorial disease and the following etiologic factors have been suggested for its development: (I) Acquired factors such as infection, and trauma, iatrogenic factors such as surgery and radiotherapy, habits, tumors, and idiopathic factors; (II) congenital

factors such as hemifacial microsomia, hemifacial atrophy, juvenile rheumatoid arthritis, and ankylosis; and (III) other factors such as muscle spasm, occlusal interferences, stress, systemic diseases, and immunological factors.[3,4]

To detect the signs and symptoms of the TMDs, first a complete medical and dental history is obtained from patients, and they are questioned about a possible history of trauma and pain. Next, clinical examination is performed starting by palpation of the muscles of mastication and neck muscles.[5] The TMJs are then palpated in jaw opening and closure, and lateral movements. Special attention should be paid to tenderness, articulate sounds, primary jaw deviations in jaw opening and closure early in the path that return to the midline, deflection (continuous deviation until the end of the opening path that does not return to midline), the amount of progressive movement, and occlusion.[1]

Although TMDs are not life-threatening, they can negatively affect the quality of life because the symptoms often become chronic and problematic over time. The common treatments for TMDs include occlusal splints, psychosocial interventions such as behavioral cognitive treatments, prescription of analgesics, and physiotherapy. However, none of these modalities led to definite treatment, which highlights the significance of implementation of preventive measures.[6] Around 20–30% of the adult population suffer from TMDs. Patients are often between 30 years and 40 years, and TMDs are more common in females. Aging often increases the TMD symptoms.[7]

Epidemiological studies have shown that TMD signs and symptoms may be found in all age groups. The prevalence of TMD is low in small children. If present, it is associated with mild signs and symptoms. However, its prevalence increases in adolescents and adults. Functional disorders of the masticatory system may be present in children during the primary dentition period. However, they often remain undetected and progress to TMDs. Thus, long-term longitudinal studies are required to predict the signs and symptoms of TMDs and reveal the possible effect of occlusal factors on growth and development of the masticatory system.[8]

Malocclusion refers to the incorrect relationship of the maxilla and mandible at the time of intercuspation. This term was first used by Edward Angle, who was the pioneer of the contemporary dentistry. Depending on the sagittal relationship of the teeth and jaws, occlusal relationships can be classified as Classes I, II, or III. Depending on transverse and vertical relations, patients may have cross bite, open bite, or deep bite.[9]

The etiology of most TMDs is not known. Two hypotheses, regarding occlusal interferences and psychological stress, have been more commonly discussed in the scientific literature in this respect.[10-12] However, none of them has been scientifically proven.[13,14] In some cases, occlusal problems are the initiator of TMDs.[13] A correlation has been reported between considerable overbite and TMDs; however, this correlation has not been permanent and stable. Attrition of the teeth, which indicates tooth wear and is a result of bruxism, has no correlation with clicking or pain in masticatory muscles.[13] Some suggested factors in the etiology of TMDs include:

1. Unintentional habits such as nocturnal bruxism, clenching, lip, or cheek biting
2. Psychological stress
3. Acute trauma or compaction injuries
4. Trauma due to extension of the head backward as in dental procedures, intratracheal intubation for general anesthesia, yawning, or neck trauma
5. Instability of the relationship of the maxilla and mandible
6. Loose joints
7. Rheumatoid, skeletal, or muscular diseases
8. Poor general hygiene and unhealthy lifestyle.[13]

Several factors such as social, individual, and financial factors, as well as medical and dental history may be involved in the prevalence of TMDs.[15] Morrant and Taylor,[16] and Williamson,[17] unlike Hirsch[18] and Sadowsky *et al*.[19] showed an association between Orthodontic treatment and TMDs. Ciancaglini and Radaelli,[20] unlike Bonjardim *et al*.[8] demonstrated an association between gender and TMDs and reported that TMDs were more prevalent in females. Fischer *et al*.[21] reported an association between head and neck trauma and TMDs,[21] Barbosa *et al*.,[22] and Restrepo *et al*.,[23] unlike Widmalm *et al*.[24] reported that parafunctional habits such as clenching were correlated with TMDs.[22-24] Basafa and Shahabi[25] evaluated 425 students, and found no significant correlation between malocclusion and TMDs. They reported that TMDs had maximum correlation with Class II malocclusion (3%) and minimum correlation with Class III malocclusion (2%).

Studies on the correlation of open bite, deep bite, cross bite, and mouth opening problems with TMDs are limited.[26,27] Thus, this study aimed to assess these correlations in Semnan city, Iran, to pave the way for further investigations in this respect. Furthermore, this study aimed to assess the correlation of TMDs with class of occlusion, deep bite, cross bite, and open bite. Given that the prevalence of TMDs is higher in patients with malocclusion; timely orthodontic treatment can help prevent the occurrence or progression of TMDs.

MATERIALS AND METHODS

In this cross-sectional study, 3000 patient records available in the archives of the Oral Medicine Department of Semnan School of Dentistry (from 2014 to 2019) were

evaluated; among which, 885 met the inclusion criteria. The inclusion criteria were complete patient records, admission between 2014 and 2019, and age range of 18–60 years (the development of the jaw and the craniofacial region has not been completed before the age of 18 years, and those >60 years have often lost some of their teeth). The exclusion criteria were incomplete patient records, condylar ankylosis, history of trauma, bruxism, or clenching, congenital anomalies of the TMJ, edentulism, and history of orthodontic treatment. A dental student evaluated the patient records regarding demographic information of patients, the results of the extraoral examination of the joint, such as the presence of articular sounds (clicking and crepitus), tenderness of the TMJ on palpation, TMJ pain, and mouth opening deviation, and the results of intraoral examinations such as examination of the teeth and dental occlusion, class of occlusion (I, II, or III), and presence of open bite, deep bite or cross bite. The patient records had been previously filled out by dental students in the oral medicine department, and the accuracy of the contents had been confirmed by the attending oral medicine specialists. The specialists had been calibrated and the patients had signed informed consent forms.

Data were analyzed using the Chi-square test and Fisher's exact test at 0.05 level of significance through SPSS version 24.

RESULTS

A total of 885 patients were evaluated, and the following results were obtained:

TMDs

Clicking (23.3%) was the most common TMD symptom, followed by deviation on mouth opening (10.6%), pain on mouth opening (2.9%), tenderness on palpation (1.4%), trismus (1.2%), and crepitus (1.1%). Of patients, 35.1% (n = 300) had at least one symptom. The maximum number of symptoms was five, seen in one patient. Furthermore, 60.2% (n = 515) were females and 39.8% (n = 340) were males. [Table 1] shows the frequency percentage of different TMD symptoms in male and female patients presenting to the Dental Clinic of Semnan School of Dentistry. As shown, none of the symptoms had a significant correlation with gender ($P > 0.05$).

Furthermore, 35% (n = 180) of females and 35.3% (n = 120) of males had at least one TMD symptom. The maximum number of TMD symptoms was five in females and three in males.

[Table 2] presents the frequency percentage of TMD symptoms in patients presenting to the dental clinic of Semnan School of Dentistry based on their age. None of the symptoms had any correlation with age of patients ($P > 0.05$).

Of all, 34.4% of patients <30 years, 35.2% of those between 30 years and 39 years, and 35.7% of patients ≥40 years had at least one TMD symptom.

Correlation of class of occlusion in the sagittal plane (Angle's classification) with gender

Of all, 76.7% (n = 659) of patients had normal (Class I) occlusion, 13.8% had Class II, and 6.2% had Class III malocclusion. Furthermore, 77.1% (n = 387) of females and 76.2% (n = 259) of males had Class I malocclusion; 15.3% of females and 11.5% of males had Class II, and 4.5% of females and 8.8% of males had Class III malocclusion. Class of occlusion had no correlation with gender ($P = 0.062$).

Correlation of occlusion in the vertical plane with gender

Deep bite

Deep bite was noted in 0.4% (n = 2) of females and 0.3% (n = 1) of males. Deep bite had no correlation with gender ($P = 1.00$).

Open bite

Open bite was noted in 1% (n = 5) of females and 0.3% (n = 1) of males. Open bite had no correlation with gender ($P = 0.411$).

Correlation of occlusion in the horizontal plane with gender

Cross bite

Cross bite was seen in 2.1% of females (n = 19) and 0.6% of males (n = 2). Cross bite had no correlation with gender ($P = 0.070$).

Correlation of class of occlusion in the sagittal plane (Angle's classification) with age

Of all, 74.3% (n = 214) of patients <30 years, 81.4% (n = 245) of those between 30 years and 39 years, and 74.1% (n = 197) of those ≥40 years had normal occlusion. Of those <30 years, 16.7% had Class II and 5.6% had Class III malocclusion. Of those between 30 years and 39 years, 11% had Class II and 5% had Class III malocclusion. Of those ≥40 years, 13.9% had Class II and 8.3% had Class III malocclusion. Class of occlusion had no correlation with age ($P = 0.293$).

Correlation of occlusion in the vertical plane with age

Deep bite

Of all, 0.3% (n = 4) of those <30 years, 0.7% (n = 2) of those between 30 years and 39 years, and none of those ≥40

Table 1: Frequency percentage of TMD symptoms in male and female patients presenting to the Dental Clinic of Semnan School of dentistry.

TMD symptom	Gender						*P*-value
	Female		Male		Total		
	Number	Percentage	Number	Percentage	Number	Percentage	
Pain on mouth opening	18	3.5	7	2.1	25	2.9	0.222
Deviation on mouth opening	55	10.7	36	10.6	91	10.6	0.966
Trismus	10	1.9	-	-	10	1.2	0.01
Tenderness on palpation	8	1.6	4	1.2	12	1.4	0.647
Clicking	116	22.5	83	24.4	199	23.3	0.523
Crepitus	6	1.2	3	0.9	9	1.1	0.692

TMD: Temporomandibular disorders

Table 2: Frequency percentage of TMD symptoms in patients presenting to the Dental Clinic of Semnan School of dentistry based on their age.

TMD symptom	Age						*P*-value
	40≤ (*n*=266)		30–39 (*n*=301)		<30 (*n* =288)		
	Number	Percentage	Number	Percentage	Number	Percentage	
Pain on mouth opening	7	2.6	9	3	9	3.1	0.939
Deviation on mouth opening	24	9	35	11.6	32	11.1	0.575
Trismus	3	1.1	4	1.3	3	1	0.939
Tenderness on palpation	4	1.5	4	1.3	4	1.4	0.867
Clicking	65	24.4	77	25.6	57	19.8	0.217
Crepitus	4	1.5	1	0.3	4	1.4	0.385

TMD: Temporomandibular disorders

years had deep bite. Deep bite had no correlation with age ($P = 0.556$).

Open bite

Of all, 2.1% ($n = 6$) of those <30 years had open bite. None of the patients >30 years had open bite. Open bite had no correlation with age ($P = 0.185$).

Correlation of occlusion in the horizontal plane with age

Cross bite

Of all, 1.7% ($n = 5$) of those <30 years, 0.7% ($n = 2$) of those between 30 years and 39 years, and 2.3% ($n = 6$) of those ≥40 years had cross bite. Cross bite had no correlation with age ($P = 0.238$).

Correlation of occlusion with TMDs

None of the TMD symptoms had any correlation with class of occlusion [Tables 3 and 4].

DISCUSSION

In this study, clicking (23.3%) was the most common TMD symptom, followed by deviation on mouth opening (10.6%) and pain on mouth opening (2.9%). However, in a study conducted by Montazemi,[15] clicking (33.9%) and pain (10.7%) were the most common symptoms. In a study conducted by Tabatabaian *et al.*,[28] in Shahid Beheshti Dental School, clicking, tenderness of the muscles of mastication on palpation, tenderness of the TMJ, and mouth opening limitation were seen in 21.3%, 18.7%, 5.3%, 18.7%, and 1.3% of patients, respectively. In a study by Khanehmasjedi *et al.*,[27] in Ahwaz, articular sounds were the most common, and limitation in lateral movements of the jaw was the least common TMD symptom. Variations in the results are probably attributed to the different sampling methods or region of study, because a number of factors such as social, individual, and financial factors, and medical and dental history of individuals can affect the development and prevalence of TMDs.[15]

In this study, despite the higher number of female patients with TMDs, the difference in this respect was not significant between males and females. Liljestrom *et al.*,[29] Nilsson *et al.*,[30] Hobson *et al.*,[31] and Ciancaglini and Radaelli[20] unlike Bonjardim *et al.*,[8] Montazemi,[15] and the current study, showed a correlation between TMDs and gender, and reported that TMDs were more common in females. Pedroni *et al.*[32] also reported higher frequency of TMDs in females. In line with our findings, Choi *et al.*[33] evaluated the prevalence

Table 3: Frequency percentage of temporomandibular disorders (TMD) symptoms in each class of occlusion in the sagittal plane in patients presenting to the Dental Clinic of Semnan School of dentistry.

TMD symptom	Class of occlusion										*P*-value
	Edge to edge		Class II subdivision		Class III (*n*=3)		Class II (*n*=118)		Class I (*n*=656)		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
Pain on mouth opening	-	-	2	11.1	1	1.9	1	0.8	21	3.2	0.342
Deviation on mouth opening	2	20	4	22.2	8	15.1	14	11.9	63	9.6	0.24
Trismus	-	-	-	-	-	-	3	2.5	7	1.1	0.613
Tenderness on palpation	-	-	-	-	-	-	2	1.7	10	1.5	0.523
Clicking	4	40	3	16.7	16	30.2	22	18.6	154	23.5	0.302
Crepitus	-	-	1	5.6	1	1.9	-	-	7	1.1	0.94

of TMDs in 19-year-old Korean males and reported that the signs and symptoms of TMDs in males were similar to those in females or mixed populations reported in other studies. In a study by Baghaee *et al.*,[1] 23.9% of males and 20.3% of females had TMDs, with no significant difference between them. Farsi,[34] Widmalm *et al.*,[35] and Magnusson *et al.*[36] found no significant difference between males and females in TMD symptoms. Variations in the results can be due to differences in assessment of signs and symptoms, methodology, higher sensitivity of females to pain and the subsequently higher likelihood of female patients seeking treatment for TMDs, as well as higher level of psychological stress in females.

In this study, 35.1% (n = 300) of patients had at least one symptom. The maximum number of symptoms was 5, seen in one patient. The prevalence of TMDs was 66.6% in a study by Jahandideh *et al.*[37] However, the prevalence of TMDs was 59.76% in females and 40.3% of males in the study conducted by Khanehmasjedi *et al.*[27] Due to the above mentioned reasons, the prevalence of TMDs in our study was lower than that in other studies.[27,37] Similarly, Carlsson and Magunsson[38] discussed that 1/2–1/3rd of the population of healthy adults had at least one TMD symptom, and over half of them had at least one clinical symptom, which was mainly tenderness of the muscles of mastication.[38] Early diagnosis and simple preventive measures can prevent the development of complications.

In this study, 33.7% of patients (n = 288) were younger than 30 years, 35.2% (n = 301) were between 30 years and 39 years, and the remaining 31.1% (n = 266) were ≥40 years. The mean age of patients was 34.8 ± 10.3 years (median of 34 years). Khanehmasjedi *et al.* reported the highest prevalence of TMDs in patients between 20 years and 30 years.[27] Another study reported the maximum frequency of TMDs in patients between 20 years and 40 years.[39]

In this study, 76.7% of patients had Class I, 13.8% had Class II, and 6.2% had Class III malocclusion. Class of occlusion had no correlation with TMDs. In the study conducted by Khanehmasjedi *et al.*,[27] 15.7% of patients had normal Occlusion, 58.8% had Class I malocclusion, 9.8% had Class II division I malocclusion, 11.5% had Class II division II malocclusion, 4.2% had Class III skeletal malocclusion, 10.6% had cross bite, 8.3% had open bite, 40.8% had abnormal overjet, 30.1% had abnormal overbite, and 59.8% had crowding.

In the study conducted by Baghaee *et al.*,[1] the maximum frequency of TMDs was noted in children with flush terminal plane occlusion (60.4%). Yilmaz *et al.*[40] evaluated 205 children between 3 years and 6 years of age and reported that 77.9% of 6-year-old children had Flush terminal plane, 13.6% had mesial step, and 8.5% had distal step. Baghaee *et al.*[1] also evaluated the correlation of TMDs with occlusion and reported that the only anterior cross bite (reverse overjet) had a significant correlation with TMDs. Mohlin *et al.*,[41] in a review study analyzed the correlation of malocclusion and orthodontic treatment with TMDs, and found no significant correlation. Beitollahi *et al.*[42] found no correlation between TMDs and malocclusion class either. However, Alamoudi[43] reported significant correlations between the posterior cross bite, edge to edge occlusion, anterior cross bite, and Class III canine relationship with TMDs. Thilander *et al.*[43] demonstrated significant correlations between TMDs and posterior cross bite, anterior open bite, Angle's Class II malocclusion, and severe maxillary overjet. Khayat *et al.*[26] evaluated the association of cross bite and deep bite with TMDs in Palestinian adolescents and showed a significant correlation between TMDs and posterior cross bite; however, TMDs had no correlation with deep bite.

In general, it appears that the correlation of malocclusion with TMDs has not been clearly elucidated, and further studies are warranted in this respect.

Table 4: Frequency percentage of temporomandibular disorders (TMD) symptoms in occlusal discrepancies in the horizontal and vertical planes in patients presenting to the Dental Clinic of Semnan School of dentistry.

TMD symptom	Occlusal discrepancy								
	Cross bite		*P*-value	Open bite		*P*-value	Deep bite		*P*-value
	n=13			*n*=6			*n*=3		
	Number	Percentage		Number	Percentage		Number	Percentage	
Pain on mouth opening	0	0	1	0	0	1	0	0	1
Deviation on mouth opening	3	23.1	0.140*	0	0	1	1	33.3	0.287
Trismus	0	0	1	0	0	1	0	0	1
Tenderness on palpation	0	0	1	1	16.7	0.082	0	0	1
Clicking	3	23.1	0.986*	0	0	0.345	0	0	1
Crepitus	0	0	1	0	0	1	0	0	1

*Chi-square test, Others: Fisher's exact test

Some previous studies evaluated muscle tenderness and pain. However, in this study, we could not evaluate these parameters because no such information was available in the dental records of patients.

CONCLUSION

The prevalence of TMDs was relatively high (35%) in our study population. Although no significant correlations were noted between TMDs and age, gender or class of occlusion, the prevalence of TMDs was slightly higher in patients with Class II malocclusion. Thus, this finding should be taken into account by patients and orthodontists.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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