ORIGINAL ARTICLE

DENTAL CHARACTERISTICS OF PATIENTS SUFFERING FROM TEMPOROMANDIBULAR DISORDERS

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Background: The role of malocclusion in the aetiology of TMDs has been discussed extensively in literature, however, the varied results from different studies have made it difficult to reach a consensus. The objective of this study was to determine the association of dental characteristics and temporomandibular disorders (TMDs). **Method:** This case-control study involved a total of 266 patients who were equally divided into 2 groups (TMD/Non-TMD) based on the score obtained from the Fonseca's questionnaire. Dental characteristics such as class of malocclusion, overjet, overbite, crossbite, and crowding were assessed. The Chi-square test was used to determine an association between each dental characteristic and TMD. Odds ratios were calculated using simple and multiple logistic regression. **Results:** Significant associations were found between crowding, crossbites, and molar relationships in males. Simple logistic regression showed significant associations for class II malocclusion (OR=0.56, p=0.024) and crowding (OR=0.35, p<0.001) with TMD. Multiple logistic regression showed significant associations for crowding (p<0.001) and class III malocclusion (p=0.002). **Conclusion:** Male patients with dental characteristics such as improper molar relationships, crossbites, and crowding should seek orthodontic treatment to prevent the onset of TMDs. Higher odds of TMD were found in patients with Angle's class III malocclusion.

Keywords: Temporomandibular Joint Disorders; Malocclusion; Crowding

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INTRODUCTION

Temporomandibular disorders (TMDs) may involve the pathology of the muscles of mastication, temporomandibular joints, and associated structures.[1] The signs and symptoms range from pain and tenderness of the affected joint, myalgia, decreased range of mandibular movement, and joint sounds such as clicking and crepitus.[2] Temporomandibular disorders have a multi-factorial aetiology which include trauma, genetic predisposition, ethnicity, psychological factors, socioeconomic factors, and various types of malocclusion.[3,4] Studies have shown that certain age groups have a tendency to experience TMDs more often and women tend to suffer from this disorder more frequently and often present for the management of pain and dysfunction.[5,6]

The role of malocclusion in the aetiology of TMDs has been debated extensively due to the inconsistent results from different studies. When the relation of TMDs with the sagittal plane, i.e., Angle's classification of malocclusion was considered, scant evidence was found in the literature. Angle's classes of malocclusion have been defined by the relationship of the mesio-buccal cusp of the maxillary first permanent molar and its relation with the buccal groove of the mandibular first permanent molar. The cusp may occlude in the buccal groove (class I), mesial to the buccal groove (class II), or may occlude distal to the buccal groove (class III).[7] Nonetheless, many morphological features which affect the functional characteristics seem to play a role in TMDs such as open bite, deep bite, and crossbite. These dental relationships may cause occlusal interferences during function and may lead to the onset of TMDs.[3] The disparate indices used in the assessment of this condition and the diverse signs and symptoms make it difficult to correlate the causative factors to these disorders. Fonseca *et al*[8] proposed an anamnestic questionnaire to identify the clinical signs and symptoms of temporomandibular disorders and classify patients as those who suffer from different grades of TMDs and those who do not suffer from TMDs.

Gesch *et al*[2] investigated the association of malocclusion and functional occlusion with TMD symptoms in a very representative and random sample in West Pomerania, Germany. None of the occlusal factors under study revealed significant associations with TMDs. On the contrary, a study by Thilander *et al*[9] found a significant association between Angle's class III malocclusion, posterior crossbite, anterior open bite, and extreme maxillary overjet with TMDs. The lack of agreement in different studies indicates that further research is required to determine an association of occlusal factors with TMD. Besides, if occlusal factors are found to be significantly associated with TMDs, then the early identification and orthodontic correction could be advised to patients to prevent the onset of TMDs. Therefore, this study was aimed to determine the

association of dental characteristics and temporomandibular disorders using the Fonseca's anamnestic questionnaire.

MATERIAL AND METHODS

A case-control study was initiated after obtaining an ethical approval from our institution's ethical review board. The sample size was calculated using the findings of Gesch *et al*[2] who reported the prevalence of dental crowding in cases as 39.1% and controls as 20.8%. With the power of the test set to 90%, it was calculated that a total of 133 (n) subjects were required in each group. Since we had two groups, a total of 266 (n) subjects took part in this study.

Patients between ages 18–35 years who presented for dental treatment were requested to complete the Fonseca's anamnestic questionnaire (Table-1) after obtaining informed consent to determine the presence or absence of TMDs. Cases were all those subjects with TMD with a duration of at least 1 week, whereas controls were all those subjects without TMD. Those subjects who had orthodontic or prosthodontic treatment, restored, extracted, missing teeth, craniofacial syndromes, history of traumatic injuries to facial structures, and systemic diseases such as osteoarthritis and rheumatoid arthritis which may have affected the temporomandibular joint and was assessed through their medical history, were excluded.

Table-1: Fonseca's Anamnestic Questionnaire

	Questions	No	Sometimes	Yes
1.	Is it hard for you to open your mouth?	□	□	□
2.	Is it hard for you to move your mandible from side to side?	□	□	□
3.	Do you get tired / muscular pain while chewing?	□	□	□
4.	Do you have frequent headaches?	□	□	□
5.	Do you have pain* on the nape or stiff neck?	□	□	□
6.	Do you have earaches or pain in temporomandibular joints?	□	□	□
7.	Have you noticed any TMJ clicking while chewing or when you open your mouth?	□	□	□
8.	Do you clench or grind your teeth?	□	□	□
9.	Do your feel your teeth do not articulate well?	□	□	□
10.	Do you consider yourself a tense (nervous) person?	□	□	□

Each patient underwent a clinical examination to determine the malocclusion, i.e., Angle's classification (class I, II, or III), crossbite, open bite, deep bite, and crowding. Overjet was measured as the horizontal distance between the most proclined incisors. Overbite was measured as the greatest vertical overlap of the mandibular incisors by the maxillary incisors. These measurements were summed and determined to be either increased, decreased, or normal. Overjet was increased when it was greater than 5 mm and reduced when it was less than or equal to 0 mm. The overbite was increased when it was greater than 5 mm and reduced when it was less than 0 mm. Contact point displacements were examined to reveal the presence or absence of dental crowding. The presence or absence of anterior and posterior crossbites was recorded. Each patient completed the Fonseca's anamnestic questionnaire to determine the presence of TMD. The answer to each question is answered with either a "yes", "sometimes", or "no", and scored 10, 5, and 0 respectively. The total score was calculated to determine whether the patient suffered from mild (20–40), moderate (45–60), or severe (70–100) TMD. Data were collected on a data collection form.

SPSS-20.0 was used for data management and analysis. Descriptive statistics were applied for the calculation of the mean age. For categorical variables such as gender and TMD, frequency and percentages were reported. Frequencies of occlusal characteristics such as Angle's class of malocclusion I, II, and III, normal overjet, increased overjet, reduced overjet, normal overbite, deep bite, open bite, presence or absence of crowding, posterior and anterior crossbite were noted. Effect modifiers such as gender were controlled via stratification. A post-stratification chi-square test was used to compare TMD and Non-TMD groups. Simple and multiple logistic regression was applied to determine the odds of TMD in patients with malocclusion. A p-value ≤ 0.05 was held as statistically significant.

RESULTS

A total number of 129 males and 137 females were included in this study. The mean age of males was 27.2±8.0 years and females was 25.7±6.8 years. The association among different Angle's classes of malocclusions, overjet, overbite, crowding, and crossbites with TMD are found in table-2.

Post-stratification chi-square test according to gender revealed a significant association between TMD and Angle's classification of malocclusion ($p < 0.001$), crowding ($p < 0.001$) and crossbite ($p < 0.001$) in males. (Table-2). The results of simple logistic regression showed significant associations between Angle's class III malocclusion (OR = 0.56, $p = 0.024$) and crowding (OR = 0.35, $p < 0.001$) and TMD. (Table-3)

Those variables which showed statistically significant differences were used to develop a model to predict the development of TMD in patients with malocclusion as compared to controls (Table-3) using the equation:

$$g(\vec{X}) = \beta_0 + \beta_1(Crowding) + \beta_2(Molar\ Class\ II) + \beta_3(Molar\ Class\ III)$$

$$g(\vec{X}) = 0.64 - 1.15(Crowding) - 0.41(Molar\ Class\ II) + 1.41(Molar\ Class\ III)$$

It depicted that the odds of TMD in a patient with Angle's class III malocclusion are 3.8 times the odds of TMD in a patient with Angle's class I malocclusion when controlled for crowding.

Table-2: A Comparison of the association of dental characteristics with TMD between genders

Parameter	Males			*p*-value	Females			*p*-value
	TMD	Non-TMD	Percent %		TMD	Non-TMD	Percent %	
Malocclusion								
Class I	45	26	55.0	< 0.001**	31	36	48.9	0.242
Class II	09	36	34.9		37	31	49.6	
Class III	09	04	10.1		02	00	1.5	
Overjet								
Normal	36	30	51.2	0.375	36	33	50.4	0.179
Increased	18	22	31.0		20	27	34.3	
Reduced	09	14	17.8		14	07	15.3	
Overbite								
Normal	36	36	55.8	0.823	37	43	58.4	0.170
Increased	18	22	31.0		28	23	37.2	
Reduced	09	08	13.2		05	01	4.4	
Crowding								
Present	45	18	51.2	< 0.001**	42	35	43.8	0.360
Absent	18	48	48.8		28	32	56.2	
Crossbite								
Normal	45	40	65.9	0.002*	52	53	76.6	0.152
Anterior	00	08	6.2		12	04	11.7	
Posterior	09	16	19.4		04	08	8.8	
Both	09	02	8.5		02	02	2.9	

$p \leq 0.05$*, $p < 0.001$**, Chi-square Test, n=266

Table-3: Simple logistic regression analysis between dental characteristics and TMD

Simple Logistic Regression			
Parameter	**Odds Ratios**	***p*-value**	**95 % C.I.**
Age	0.99	0.367	(0.95,1.02)
Gender	1.09	0.713	(0.68,1.77)
Malocclusion			
Class II	0.56	0.024*	(0.33,0.92)
Class III	2.24	0.184	(0.68,7.29)
Overjet			
Increased	0.68	0.161	(0.39,1.17)
Reduced	0.96	0.903	(0.48,1.89)
Overbite			
Increased	1.10	0.703	(0.66,1.86)
Reduced	1.68	0.254	(0.69,4.12)
Crowding	0.35	<0.001**	(0.21,0.58)
Crossbites			
Anterior	0.96	0.923	(0.41,2.24)
Posterior	0.52	0.080	(0.19,1.54)
Both	2.64	0.107	(0.68,11.11)

C.I.: Confidence Interval, $p \leq 0.05$*, $p < 0.001$**, n=266

Table-3: Multiple logistic regression analysis between dental characteristics and TMD

Multiple Logistic Regression				
Parameter	**ß$_0$ Coefficient**	**ß Coefficient**	***p*-value**	**C.I.**
Crowding	0.64	-1.15	< 0.001**	(-1.67, -0.62)
Class II		-0.41	0.127	(-0.94, 0.17)
Class III		1.40	0.002*	(0.17, 2.65)

DISCUSSION

This study was conducted to determine an association between different dental characteristics and temporomandibular disorders (TMDs). The global prevalence of TMDs varies between 7–40% according to Luther.[10] A wide range may indicate discrepancies between the indices of measurement and the variability in expression of the signs and symptoms of this condition.[11] Fonseca's anamnestic questionnaire has proved to be an efficient and low cost TMD screening and analysis tool.[12] It has been used in different populations to determine the prevalence of TMD. A study by Karthik et al[13] showed an incidence of mild TMD as 19.3% and moderate TMD as 2.7% with the Fonseca's anamnestic questionnaire. Nomura et al[14] found that 35.75% had mild TMD, 11.93% had moderate TMD, and only 5.5% reported severe TMD. We found that 76.7% of TMD patients were categorized under a mild condition, 21.2% in moderate, and 2.3% were suffering from severe TMD. The differences in the

distribution of subjects in the severity of the condition is due to the difference in study design. To compare the frequency of patients in different categories of severity, the group labelled as cases was used. This was predetermined to have TMD as defined by the Fonseca's anamnestic questionnaire and is likely to display greater frequencies in all grades of severity.

TMDs predominantly affect the female gender.[15] Possible explanations that have been put forth include the lower threshold for pain, greater levels of emotional stress, and earlier muscle fatigue.[5] It has also been noted that females are more likely to present for treatment of TMD and this has been used to justify the usual finding of a larger number of females presenting for the treatment of TMDs.[16] Therefore, all results were stratified according to gender.

Occlusion has been suspected to be an etiological factor since the earliest reports on TMDs.[17] Various other possible causes of TMDs have been identified to be parafunctional habits, trauma, emotional stress, and deep pain input.[18] However, conflicting results make it difficult to determine the role of occlusion in the development of these disorders.[12] Interestingly, in this study, none of the various dental characteristics were found to be significantly associated with TMDs in female subjects. However, in males, significant associations were found between TMDs and Angle's classification of the malocclusion, crowding, and crossbites. This is in partial agreement with a large scale population based study by Egermark *et al*[19] which didn't report an association between dental characteristics and TMDs except for unilateral crossbites and lateral forced bite in the intercuspal position (ICP). Our results indicate that males who present with Angle's class II or class III malocclusions, crowding, and crossbites should be advised orthodontic correction. One may question these results as the female gender is more commonly affected by this condition, however, it should be noted that this study particularly considers occlusal factors and their association with malocclusion. A greater incidence of TMDs in females may be encountered when various aetiologies are considered as described in many studies, but the isolated association with occlusal factors indicates otherwise.

Longitudinal studies have shown that those patients who exhibit symptoms of TMDs at a certain age may not show those symptoms later in life.[5] For example, a study reported the prevalence to be greatest between 20–40 years of age.[20] However, Thilander *et al*[9] indicated that symptoms increased during development between 5–17 years of age, whereas the odds of developing TMDs were not any different when comparing age and gender. Our sample consisted only of adult patients with ages ranging from 18–35 years. It is possible that the fact that subjects were not studied in distinct age groups yielded a non-significant association between age and TMD. The odds of developing TMDs were greater for Angle's class III malocclusion which was in concordance with several other studies.[5,9] Although Bourzgui *et al*[21] found statistically insignificant differences between various occlusal factors and TMDs, Marklund, and Wänman,[22] Sonnesen and Svensson,[23] and Marangoni *et al*[24] found that crossbites, deep bites, and open bites also showed greater odds of developing TMDs, respectively.

Studies reporting the prevalence of a certain disorder must fulfil several criteria. Studies should be based on a large sample size which is truly representative of the population. Although this study had a reasonable number of subjects, a larger sample size would be preferred. Besides, all subjects were recruited at a single tertiary care hospital. A multicentre study would ensure that the population is well represented. The diagnosis of TMD was only based on the questionnaire, while malocclusion was assessed only on clinical examination, without skeletal diagnosis with a cephalogram. TMDs are a very complex disorder and numerous factors have been identified which affect TMDs. Therefore, to correctly identify occlusion as a sole causative factor it is necessary to identify a group of individuals with absolute similar characteristics and determine the prevalence of TMDs. Furthermore, functional occlusal factors such as non-working side contacts and occlusal interferences were not evaluated in this study, whereby only the coexistence of malocclusion and TMDs was identified in this study.

CONCLUSION

The results of our study found that Angle's classes of malocclusion, crowding, and crossbites can coexist with TMDs in males as diagnosed by the Fonseca's anamnestic questionnaire. The odds of TMDs in patients with class III malocclusion are 3.8 times those of TMDs in class I patients when controlled for crowding.

AUTHORS' CONTRIBUTION

ATK and MF were involved in topic selection. ATK performed the data collection, data analysis and wrote the preliminary draft of the manuscript. RHS performed the regression analysis and interpretations. MF and RHS critically reviewed the manuscript before final submission.

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