

Comparison of signs and symptoms of temporomandibular disorders in orthodontic and non-orthodontic patients presenting at a tertiary care hospital in Karachi, Pakistan

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Abstract

Introduction: Temporomandibular disorder (TMD) is a collective term involving the pathology of the temporomandibular joint and masticatory muscles. It has been speculated whether orthodontics can exacerbate or relieve symptoms of TMD. So far, orthodontics is not accepted as a remedy of this condition. The objective of this study was to evaluate the signs and symptoms of TMD seen in orthodontic patients compared to signs and symptoms existing in nonorthodontically treated patients by utilizing the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).

Material and Methods: A sample of 200 patients was used. This study was a cross-sectional study. The sample was divided into a control group of (100 patients) and a study group of (100 patients). The RDC/TMD was used to record signs and symptoms of joint dysfunction i.e. clicking, crepitus, tenderness to palpation, mouth opening, and lateral excursions. Subjects' psychological status was also evaluated to determine links between depression and somatization.

Results: 85% of control and 84 % of the study group had no TMD symptoms in the past six months. 18% of control and 12% of the study presented with joint clicking. Mean mouth opening (control) was noted as 42.4mm and 44 mm (study). 22% of control had restricted mouth opening <40 mm as compared to 28% of study sample. No statistical significance was noted between different variables except depression and tenderness ($p = .033$), headaches ($p = .005$), chronic pain, ($p = .000$) and self-reported clenching ($p=.000$).

Conclusions: A significant relationship exists between TMD and depression and somatization. Clenching, muscle and joint tenderness, headaches, and chronic pain were more frequently noted with patients suffering from depression.

Key words: RDC/TMD, Joint sounds, Crepitus, pain, Angle's Classification of Malocclusion

Introduction

Orthodontics, like other dental specialties, can affect the temporomandibular joint. A patient can experience a number of symptoms during treatment, but not all patients presenting with symptoms develop TMD. In the past, many studies have indicated that TMD is not caused by orthodontic treatment.⁷

Bales JM and Epstein JB²⁴ reviewed literature

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to assess the role orthodontic therapy in preventing and treating TMD. It was found that orthodontic therapy may not affect the risk of developing TMD and has little role in treatment. Leite RA²² also investigated the relationship between temporo-mandibular disorders and orthodontic treatment. After critically reading and assessing articles over the past 15 years, 20 articles were identified which had assessed the role of orthodontics in TMDs. All studies reported that orthodontic treatment did not cause or increase the risk to the development of signs and symptoms of TMD. This was regardless of the technique used for treatment, the extraction or non-extraction of premolars and the type of malocclusion. This author also stated that

some of the studies indicated orthodontic treatment would not be preventive or a treatment option for TMD.

Temporomandibular dysfunction describes a condition that presents with a number of signs and symptoms which affect the temporomandibular joint (TMJ) and the surrounding structures, but the pain is of non dental origin. The signs and symptoms that a TMD patient presents with, vary from pain in the TMJ and masticatory muscles, headaches, ear pain, disruption of normal mandibular function to joint clicking or crepitus.⁶ A reliable scale used to record TMD signs and symptoms is the Research Diagnostic Criteria.²¹ A patient suffering from mild initial TMD signs can be differentiated from one that may be more predisposed to TMD. It provides researchers to diagnose a clinical condition and carry out a psychological evaluation.

It has been an area of interest that whether there exists any correlation between TMD and morphological and functional malocclusion.^{5,7} Morphological malocclusion has been divided into three classes by Edward Angle; I, II, and III. Another type of malocclusion is functional malocclusion. Functional malocclusion has been defined as occlusion or the relationship between the maxilla and mandible, which is not in harmony with mandibular movement and cuspal interferences which may cause disturbances to the masticatory system.⁵

TMD can be caused by many factors such as unstable occlusion, malocclusions, stress and other psychological factors, trauma, genetic predisposition, ethnicity, social class and psychological status.⁶ Previous studies have indicated that orthodontics does not cause TMD. In fact, patients evaluated at the start of treatment and after treatment in longitudinal studies show that symptoms were not created during treatment.²⁵ In 2002, Ana Conti evaluated the prevalence of TMD in individuals before and after orthodontic treatment. The presence and severity of TMD

did not have a relationship with type of orthodontic mechanics or extraction protocols and they concluded that orthodontic treatment does not predispose subjects to TMDs, nor is it, therapy for TMD patients. It was also noted that parafunctional habits and emotional stress do play a role in TMD.³

Material and Methods

- The study design was cross-sectional/analytical, carried out over a 9 month period at Altamash Institute of Dental Medicine Karachi, Pakistan.
- The sampling technique used was simple random sampling. A total sample size of 200 was used which was divided equally into a study group and a control group.
- The study group represented those patients who were undergoing orthodontic treatment. The control group represented those who had not undergone orthodontic treatment and had presented for other dental procedures.
- The RDC/TMD index was used to evaluate patients. The RDC/TMD index consists of two parts (axis I and axis II) Axis I is comprised of a history questionnaire along with frequent symptoms of TMD. A clinical examination was carried out by a trained doctor which involved; measurement of the mandibular range of movement, palpation of the TMJ to note any joint sounds or crepitations, palpation of the TMJ and muscles of mastication for tenderness. The TMD algorithm supplemented by the RDC/TMD helped diagnose if the patient is suffering from either Group I: Muscle Disorders, Group II: Disc Displacement, or Group III: Joint Pathosis
- Mandibular Range of Motion: Mouth opening was measured with a millimeter ruler from upper central to the lower central incisors (<40 mm being restricted opening). Lateral excursions were measured from upper midline to lower

midline (<10 mm being restricted excursive movements).

- Axis II is a behavioral assessment and determines if the subject suffers from a depressed psychological state or a chronic pain state. The behavioral assessment included questions that were related to depression, non specific physical symptoms with pain, and nonspecific symptoms without pain. The graded chronic pain scale classifies the patient as follows: Grade 0: No TMD pain in the last 6 months, Grade I: Low Intensity, Grade II: High Intensity, Grade III: Moderately Limiting, and Grade IV: Severely Limiting

Inclusion criteria consisted of:

- Patients who presented at the AIMD orthodontics OPD and were undergoing orthodontic treatment (study group). The control comprised of patients who visited for various other dental procedures.
- Patients with any dental classification.
- Patients of all ages and gender.
- No congenital abnormalities such as cleft lip and palate or other syndromes.
- Patients who had no history of oro-facial trauma.

Exclusion criteria consisted of:

- Patients who have had previous orthodontic treatment.
- Patients with congenital abnormalities e.g. cleft lip and palate, missing teeth
- Patients with a history of oro-facial trauma.
- Patients with missing teeth, crowns, implants.

Analysis was performed with SPSS 17.0. The different variables were assessed using descriptive statistics including counts, which were: gender, age, class of dental malocclusion, parafunctional habits (bruxism, clenching), measurement of mouth opening and lateral excursions, joint and muscle tenderness, joint sounds. These were then crosstabulated with type of joint dysfunction, depression score, and graded chronic pain

score according to RDC/TMD. The chi-square test was then used to determine the level of significance ($p \leq 0.05$) of each variable in both groups.

Results

The total sample consisted of two hundred patients, divided equally into a study group and control group of one hundred patients. The study group comprised of 22% males and 78% females (Ages 12-45 yrs, mean 18.48). The control group comprised of 36 %males and 64% females (Ages 10-35 yrs, mean 21). No significant association was noted between TMD and age in the study group ($p = .978$) or control group ($p = .985$), nor was there any significance between TMD and gender in the study group ($p = .353$) or control group ($p = .658$).

Mean mouth opening (control group) was noted as 42.4mm and 44 mm (study group). 22% of control group had restricted mouth opening¹ <40 mm as compared to 28% of study sample (Table I and II). There was no statistical significance ($p=0.147$) noted between TMD and mandibular range of movement. 85% of control group and 84 % of the study group had no TMD symptoms in the past six months. 18% of control and 12% of the study presented with joint clicking. 20 % of females of the control group showed joint clicking, whereas 10% exhibited clicking in the study group (Table III) There was no statistical significance between joint clicking and TMD ($p= 1.000$).

Patients presenting for orthodontic treatment did not complain of bruxism or

Table I: Control vs Study

	Mean Values (mm)	
	Study	Control
Overjet	3.24	3.29
Overbite	4.18	3.58
Mouth Opening	44.12	42.41
Protrusion	3.59	8.82

Table II: Lateral excursions

Lateral Excursions		
	No. of Patients	
	Study	Control
< 8 mm	19	12
8 ≤ 10 mm	27	40
>10 ≤ 12 mm	30	35
> 12 mm	24	13

Table III: Joint dysfunction

Joint Dysfunction			
		Control	Study
Axis I	No Diagnosis	98%	99%
	Myofacial Pain Dysfunction	2%	1%
Axis II	No Diagnosis	96%	97%
	Right Disk Displacement With Reduction	2%	---
	Left Disk Displacement With Reduction	1%	3%
	Right & Left Disk Displacement With Reduction	1%	---
Axis III	No Diagnosis	99%	98%
	Arthralgia	1%	1%
	Osteoarthritis	---	1%

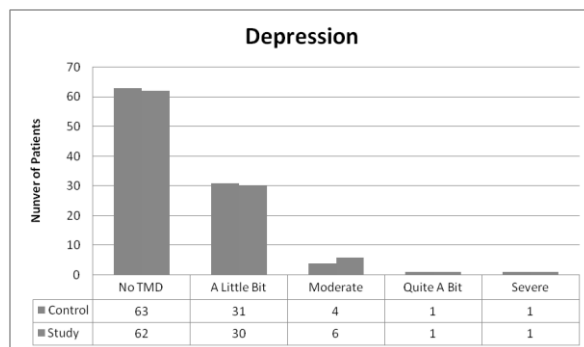
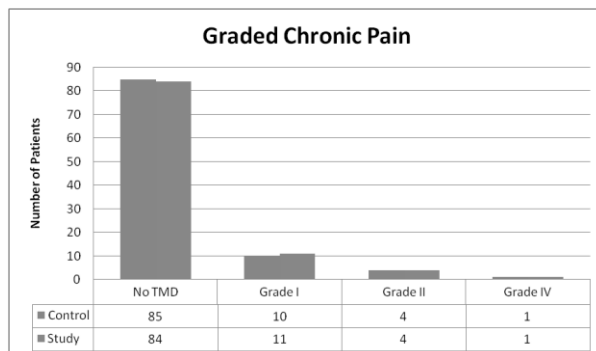
clenching (76%), as compared to the control; no bruxing or clenching (76%). No tenderness was reported by 74% of the study, as compared to 84% of the control, 18% of the study group responded positively to less than 3 sites for tenderness (3% of control, and 8% of the study group responded positively to more than 3 sites of tenderness). Females generally reported positively to tenderness more than men. We noted a significant association between depression (Figure 1 & 2) and tenderness ($p = .033$), headaches ($p = .005$), chronic pain, ($p = .000$). Self-reported clenching showed a statistical significance ($p = .000$).

Discussion

TMD has a multifactorial etiology because it is a complex structure affected by a variety of variables. It would be best to isolate and deal with each variable separately, but the isolation of the variables is impossible.¹¹ Instead, it is wiser to adopt a manner of consistency and periodical review of subjects. The role of orthodontics in the development of temporomandibular joint dysfunction has been speculated over the years. Despite great controversy, studies have shown that orthodontic treatment has not produced symptoms of TMD.^{3, 25}

In order for the sample to best represent the population and to determine the prevalence of TMD, we must have strict control of the following factors: age, gender, ethnicity, socioeconomic status and psychological status.⁴ Schmid-Schwab²² concluded that younger females (below 25yrs) or older (above 50 yrs) are more likely to develop TMD, whereas men showed an even age distribution, as did other studies.^{3, 16} Our results showed no significant association between age and TMD in patients undergoing orthodontic treatment ($p = .978$).

Females have been seen to be more prone to developing symptoms of TMDs. Generally, women report a greater intensity of TMD symptoms as compared to men.¹³ That being

**Figure 1: Depression****Figure 2: Graded chronic pain**

said, we noted that women reported positively to tenderness as compared to men and also to a greater number of sites which were tender in the oro-facial region. Khurram Ataullah,⁸ Abid Ashar, Farrukh Mumtaz, Rabia Anees, Eille Fatima investigated the frequency of TMD in undergraduate dental and medical students in Lahore, Pakistan using the RDC/TMD. TMD had a greater prevalence in females. A number of studies show that females suffer from pain and tenderness.^{3,10,13,16,24} Caselin Martinez¹⁸ investigated the prevalence of TMD using the RDC/TMD in a sub-urban community in Mexico. It was found that the study showed no statistically significant difference between sexes. Our study also found that the association of gender and TMD pain was non-significant ($p = 0.658$). This study comprised of subjects from the same ethnicity.

Daniele Manfredini¹⁷ assessed the association of TMJ clicking with malocclusion in TMD patients as joint click sounds are recognized as an early sign of dysfunction. This study found no clinical relevance between TMJ clicking and malocclusion and concluded that orthodontic treatment to correct TMJ sounds should not be performed. 18% control and 12% of the study group presented with joint clicking, however orthodontic patients in our study proved no significant association between dental malocclusion and joint sounds ($p = .990$). There was also no significant relationship noted between TMD and joint sounds. ($p = 1.000$) As previous studies have indicated,^{1,3,10,14,20} joint clicking cannot be considered a precondition of TMD. Both morphological and functional occlusions are thought to play a role in TMDs. Inger Egermark¹⁴ analyzed the influence of orthodontic treatment on signs and symptoms of temporomandibular disorders and different malocclusion during a 20 year period. They found no differences in the prevalence of TMD signs and symptoms between subjects with or without orthodontic treatment. Class II division II is one possible

morphological malocclusion pattern which has been considered as a possible risk factor for Temporomandibular disorders (TMD) because of its anatomical characteristics.³⁰ Zuaiteer S, Robin O, Gebeile-Chauty S, Raberin M,³⁰ conducted a literature review to determine whether a link existed between Class II Division 2 and TMDs but they could not find a significant relationship between the two. Our study also could not establish any significance between morphological malocclusion and TMD ($p=.991$). Sidorenko de Oliveira Capote et al²⁰ claimed that functional malocclusion plays an important role in developing TMD. It has been noted that overjet, deep bite, open bite, midline shifts, are greatly associated with pain, tenderness, and clicking.^{20,25,27} No significant association was noted between these factors of functional occlusion and the signs of TMD. Patients suffering from TMD may complain of limited mouth opening. An acceptable mean value of mouth opening has been determined as 40mm.¹² Gomes²⁹ correlated the severity of TMD with the mandibular range of motion and the severity of signs and symptoms of TMD was not associated with mandibular range of motion. The present study did not find the severity of TMD significantly associated with the range of mandibular motion ($p=0.147$).

It has been debated that TMD can be caused due to premolar extractions and retraction of the anterior teeth. This most likely causes the condyle to be repositioned to a more posterior position in the glenoid fossa thus producing symptoms. However, no evidence was found supporting concerns over extraction or non extraction treatment.¹⁶

Bengt Olof Mohlin¹⁶ compared adolescents with moderate to severe dysfunction and those without TMD symptoms and their further development at 30 years of age. Fluctuations were observed in the signs and symptoms of TMD. However, psychological distress showed greater incidence of muscle tenderness. Where depression and

somatization have shown to be associated with TMD,^{26,27,28} we noted a significant association between depression and tenderness ($p = .033$), headaches ($p = .005$) and chronic pain ($p = .000$). It was noted that bruxism, clenching, psychosocial factors are fundamental for pain symptoms to occur.^{1,14, 20} Self-reported clenching showed a statistical significance ($p=.000$) again emphasizing that emotional tension most possibly causes a reduction in the bodies tolerance to pain.²⁷

Limitations of the study:

- The patients undergoing orthodontic treatment were mainly adolescents (10-20yrs), therefore we were not able to observe TMD signs and symptoms in older age groups nor could we conclude if TMD is more likely to present at a younger or older age.
- A larger sample size would better establish links between malocclusion and TMD. Other factors of functional malocclusion such as posterior cross bite, anterior or posterior open bites and the discrepancy between retruded contact position and maximum intercuspation have shown to cause TMD symptoms and were not evaluated in this study.
- Research shows that longitudinal studies are required to prove whether TMD signs and symptoms develop before, during or after orthodontic treatment. A potentially effective study would be characterized by a pre-treatment and a post-treatment evaluation. The role of orthodontics in TMD can then be clearly illustrated at long term review of those subjects.¹⁵

Conclusions

Numerous studies have been undertaken to resolve the dispute between TMDs and orthodontic treatment. After carrying out our investigations we can conclude:

- Orthodontics is not a causative factor in TMD etiology. The comparison of signs and

symptoms showed no difference in prevalence of TMD between the two groups. Orthodontics is not a treatment for TMD.

- The severity of TMD does not cause limitation in mandibular movement.
- It is safe to conclude that morphological malocclusion and the factors of functional malocclusion we noted do not predispose to joint dysfunction.
- A significant relationship exists between TMD and depression and somatization. Clenching, muscle and joint tenderness, headaches and chronic pain were more frequently noted with patients suffering from depression. Emotional stress has shown to affect the TMJ and its associated structures and demonstrates how our general health can be affected by it.

However, longitudinal studies involving orthodontic patients, studies focusing on functional disturbances of occlusion, research aimed at the assessment of psychological states and its link with TMD are still required to better understand this disorder.

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