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PREVALENCE OF TEMPOROMANDIBULAR DISORDERS AMONG ORTHODONTIC PATIENTS (CROSS-SECTIONAL CLINICAL SURVEY)

Manar Souhail Youssef
Clinical Instructor, Faculty of Dentistry, Beirut Arab University, Beirut, Lebanon, manaryoussef@doctor.com

Ahmad Tarabaih
Assistant Professor of Public Health & Pediatric Dentistry, Faculty of Dentistry, Beirut Arab University, Beirut, Lebanon, a.tarabaih@bau.edu.lb

Aly Osman
Assistant Professor, Division of Orthodontics, Department of Developmental Sciences, Faculty of Dentistry, Beirut Arab University, Beirut, Lebanon, a.osman@bau.edu.lb

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PREVALENCE OF TEMPOROMANDIBULAR DISORDERS AMONG ORTHODONTIC PATIENTS (CROSS-SECTIONAL CLINICAL SURVEY)

Abstract

Orthodontic treatment as a risk factor for the development of temporomandibular disorders (TMD) has been a controversy in literature. The aim of this study was to evaluate the prevalence of TMD, as defined in the Diagnostic Criteria (DC)/TMD Axis II, among orthodontic patients. A cross-sectional study (N=180) consisted of 3 groups: 60 control patients seeking orthodontic consultation, 60 patients undergoing orthodontic treatment for 3-5 months, 60 patients undergoing orthodontic treatment for 10-14 months. Patients answered a structured questionnaire that rated their oral parafunctions according to the Oral Behavior Checklist (OBC), pain intensity levels according to the Graded Chronic Pain Scale (GCPS), jaw functional limitations according to the Jaw Functional Limitation Scale 20 (JFLS-20), psychosocial factors (PHQ-9) and somatization levels (PHQ-15). The Chi Square test showed a statistically significant difference p-value=0.001 among both active orthodontic groups (3-5 months/10-14 months) regarding masticatory limitation (53.3%), vertical mobility limitation (41.7% for 3-5 months and 55.0% 10-14 months) and verbal & emotional expression limitation (53.3% 3-5 months and 66.7% 10-14 months). The findings revealed that as orthodontic treatment progresses, the limitation increases. Moreover, no statistical significance was observed between the three groups regarding oral parafunctional habits, chronic pain levels, psychosocial status and somatization. Orthodontic treatment is not a major factor associated with the symptoms of the TMD. Further prospective studies are needed to evaluate the true role of orthodontic treatment in the development of TMD.

Keywords

Prevalence, Cross Sectional Study, Temporomandibular Disorders, Orthodontic Treatment, DC/TMD Axis II

1. INTRODUCTION

Temporomandibular disorder (TMD) is an umbrella term that describes a group of conditions involving the masticatory musculature, the temporomandibular joint (TMJ) and associated structures (Shaffer et al., 2014). Most common manifestations are pain in the facial muscles and TMJ region, functional disturbances, and limitations in jaw movements. Other features include articular noises and disc displacements, difficulties in chewing and cutting food, headaches, ear fullness, earache, tinnitus, and dizziness (List & Jensen 2017).

The etiology and pathogenesis of TMD are still unclear as this disorder seems to have a multifactorial cause with interaction of psychological, genetic, neurological and occlusal factors (Chisnoiu et al., 2015). TMD patients report an increased somatic awareness, sleep disturbances, stress, anxiety, and somatization problems (Fillingim RB et al, 2013). In turn, occlusal disharmony, when associated with psychological distress, can release tensions through the stomatognathic system potentiating the symptoms of pain and joint disorders (List & Jensen 2017).

Among the potential factors, there has been considerable controversy regarding the relationship between orthodontic treatment and TMD. Some clinicians claimed that orthodontic treatment is related to the presence of signs and symptoms of TMD (Hwang SH, Park SG, 2018), while others reported no relationship exists between the two (Egermark I et al, 2003).

The multifactorial nature of TMD is also reflected in suggested diagnostics systems, in which psychosocial assessment is strongly recommended to be a part of TMD examinations. Research Diagnostic Criteria for TMD (RDC/ TMD) was launched in 1992, and aimed to provide a consistent physical assessment in addition to psychosocial evaluation that might affect treatment and prognosis. This biopsychosocial model of pain was incorporated by a two-Axis model: Axis I which provided a TMD related physical diagnosis, and Axis II which assessed the psychosocial condition and pain-related disability (Dworkin SF, LeResche L.,1992). Since the establishment of RDC/TMD, it has been routinely used in both research and clinical settings (Manfredini D et al, 2013). In 2014, a revised version of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) was introduced. The DC/TMD also consists of a dual-Axis system where Axis I consists of diagnostic criteria that describe clinical signs and symptoms of pain-related and intra-articular features of TMD. The DC/TMD Axis II is based on reliable and valid questionnaires that aim to evaluate TMD related psychosocial and behavioral status (Schiffman E et al, 2014).

In the clinical scenario, it is found that the development of TMD signs and symptoms in orthodontic patients is unpredictable. As a matter of fact, previous investigations were based on a simple history-taking of past orthodontic interventions. A systematic review (Luther F et al, 2010) concludes that there are insufficient research data on the association between active orthodontic treatment and TMD on which to support our clinical practice. Therefore, the primary aim of this study was to evaluate the cross-sectional prevalence of TMD diagnoses among orthodontic patients as defined in the DC/TMD Axis II.

2. MATERIALS AND METHODS

This cross-sectional study was performed with a sample of 180 male and female patients from the diagnostic clinic and orthodontic clinic at Beirut Arab University, Faculty of Dentistry. at Faculty of Dentistry, Beirut Arab University. Patients were recruited consecutively between 24th of July and 27th of November during the year 2019, and were included in the study if they met the following criteria: (1) Over 15 years of age; (2) Have good comprehension of verbal/written Arabic or English Languages. On the other hand, patients were excluded if they had: (1) Acute pain or trauma; (2) Mental comprehensive difficulties; (3) Cleft lip and/or palate or other craniofacial syndromes. Participants were allocated into three main groups: (1) 60 control patients seeking orthodontic consultation before active treatment; (2) 60 patients undergoing orthodontic treatment for 3-5 months (leveling and alignment stage); (3) 60 patients undergoing orthodontic treatment for 10-14 months (finishing stage). This study was revised and approved for scientific validity and methodology by the Institutional Research Review Board at Beirut Arab University, Faculty of Dentistry at Beirut Arab University, Faculty of Dentistry (approval code: 2020-H-0107-D-M-0382). All participants agreed to participate in this study and signed the consent form. A translation of the DC/TMD Axis II questionnaire form from the English source language to Arabic was performed, in which the official guidelines of the DC/TMD consortium were mostly followed (Appendix 1 and Appendix 2). The process involved forward and backward translations, review and cultural adaptation into Arabic language with the help of professional

translators, discussions in expert teams and field testing with TMD patients. As for the DC/TMD Axis II, the main strength lies in the rating of parafunctional behavior, jaw disability, chronic pain, and depression/somatization levels, as it provides validated questionnaires to assess psychosocial aspects that have to be addressed at a therapeutical level (Suvinen TI et al, 2005). Oral Behavior Checklist-OBC is developed in order to better determine the presence of parafunctional habits. OBC is an instrument commonly used in research and clinical settings. It is a self-reporting questionnaire consisting of 21 questions that quantify the frequency of observable and non-observable parafuctional habits (e.g. clenching, grinding, chewing gum, holding objects.). Scoring can be computed as the sum of the number of items with non-zero response. An OBC summary score of 0-16 appears to represent normal behaviors, while a score of 17-24 occurs twice as often in those with TMD, and a score of 25-62 occurs 17 times more often. As a risk factor for TMD, only a score in the 25-62 range contributes to TMD onset (Markiewicz, M. R., et al. 2006). Graded Chronic Pain Scale-GCPS consists of six items to be evaluated on a 10-point scale, and one item to indicate the number of disability days due to facial pain. The scoring method is simple to use, and allows classifying patients feeling pain into five levels of chronic pain grades (0, no disability; 1, low disability, low pain intensity; 2, low disability, high pain intensity; 3, high disability, moderately limiting; 4, high disability, severely limiting) (Von Korff, M., 2011). Jaw Functional Limitation Scale-JFLS was initially developed as an 8-item global scale to describe functional limitation of the masticatory system; the instrument was then expanded to also include masticatory limitation, vertical mobility limitation, and verbal and non-verbal communication limitation. It is now comprised of 20-items that also retain the items for the short global scale. Subscale scores for each type of functional limitation are computed, as follows: (1) Mastication: mean of items 1-6; (2) Mobility: mean of items 7-10; (3) Verbal and non-verbal communication: mean of items 13-20. A second type of global score can be obtained from the long form by computing the mean of the 3 subscale scores. Based on comparison of individuals who were lifetime negative for TMD to those with chronic TMD, observed scores of TMD patients were as follows: (1) A mean of 2.22 (SE=0.13) for mastication or vertical mobility limitation; (2) A mean of 0.72 (SE=0.10) for verbal and emotional expression limitation; (3) A mean of 1.74 (SE=0.11) for the global score (Ohrbach et al., 2008). Patient Health Questionnaire 9-PHQ-9 is a reliable and valid measure of depression severity and other mental disorders commonly encountered in primary care. It includes 9 questions assessing depressed mood and are interpreted quantitatively. Questions are scored by adding the individual responses, and a total sum score is computed. A score of 0-4 is considered minimal, 5-9 indicated mild depression, 10-14 is moderate, 15-19 is moderately severe and 20-27 indicates presence of severe ongoing depressive disorder (Kroenke, K et al., 2002). Patient Health Questionnaire 15-PHQ-15 is a brief, self-administered questionnaire that may be useful in screening for somatization and in monitoring somatic symptom severity in clinical practice and research. It includes 15 questions and assesses non-specific physical symptoms. Due to ethical/cultural reasons, question 12 in the PHQ-15 was not included. The mean scale score is calculated by summing up the score of the single items. This makes possible to rate patients as having minimal somatization severity if score is 0-4, low with a score of 5-9, medium if score is 10-14, and high if scored 15-28 (Kroenke, K et al., 2002). Statistical analyses of the data were performed using the Statistical Package for the Social Sciences (SPSS) for Windows (Chicago, IL, USA, version 25.0). The level of significance level was set at $p \leq 0.05$. Mean and standard deviation were used for the description of continuous variables. Frequency and percentage were used for the description of categorical variables. Chi square tests and Fisher Exact tests were executed to compare the categorical outcomes among the three groups. Chi square tests and Fisher Exact tests were also conducted to compare the categorical variables between men and women.

3. RESULTS

One-hundred and eighty participants (86 male and 94 females) aged 20.02 ± 4.395 years were included in the study. The age of males was 20.37 ± 4.607 years, while that of females was 19.70 ± 4.191 years. 60 participants were included before orthodontic treatment: 26 males (mean age: 21.96 ± 4.812 years) and 34 females (mean age: 20.74 ± 4.481 years). 60 were orthodontic patients at 3-5 months of treatment: 30 males (mean age: 18.80 ± 3.585 years) and 30 females (mean age: 19.27 ± 3.759 years). 60 were orthodontic patients at 10-14 months after treatment: 30 males (mean age: 20.57 ± 4.953 years) and 30 females (mean age: 18.97 ± 4.165 years).

The percentage related to oral parafunctional habits, graded chronic pain scale, jaw functional limitation scale, depression and somatization levels in orthodontic patients before treatment, 3-5 months and 10-14 months of treatment are displayed in the following bar diagrams:

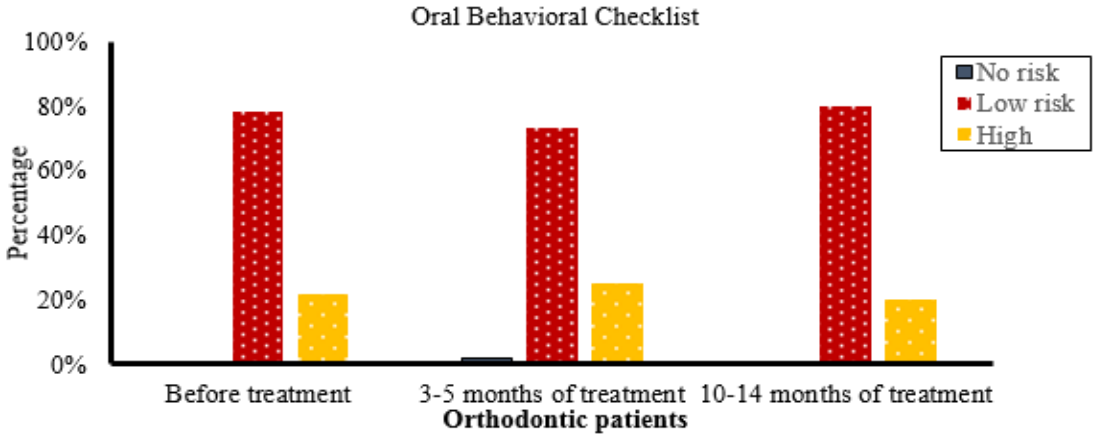

Fig.1: Percentage Related to Oral Behavior Checklist among Orthodontic Patients

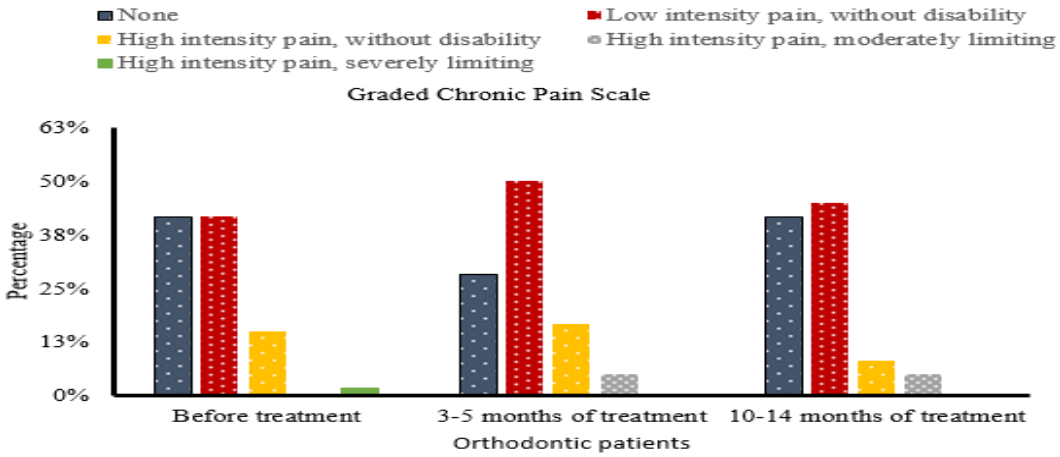

Fig.2: Percentage Related to Graded Chronic Pain Scale among Orthodontic Patients

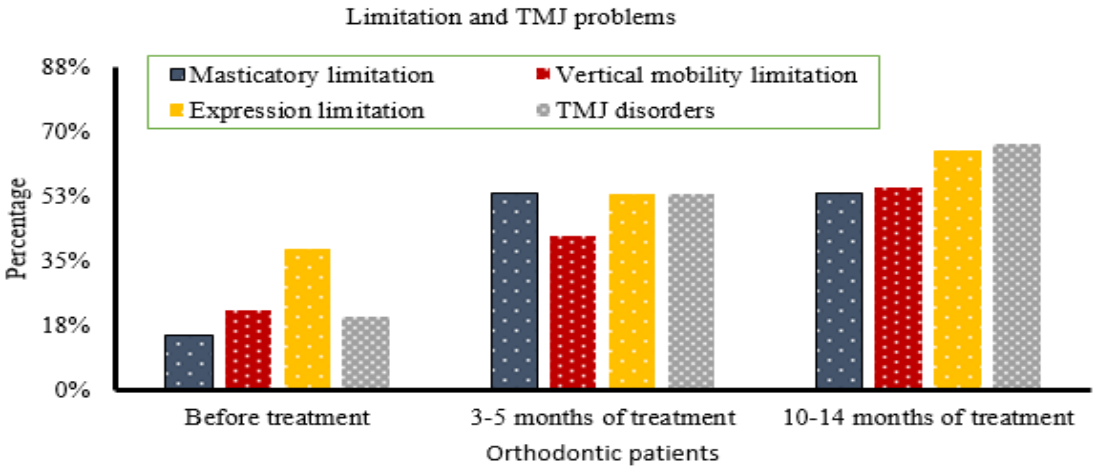

Fig.3: Percentage Related to Limitations and TMJ Problems among Orthodontic Patients

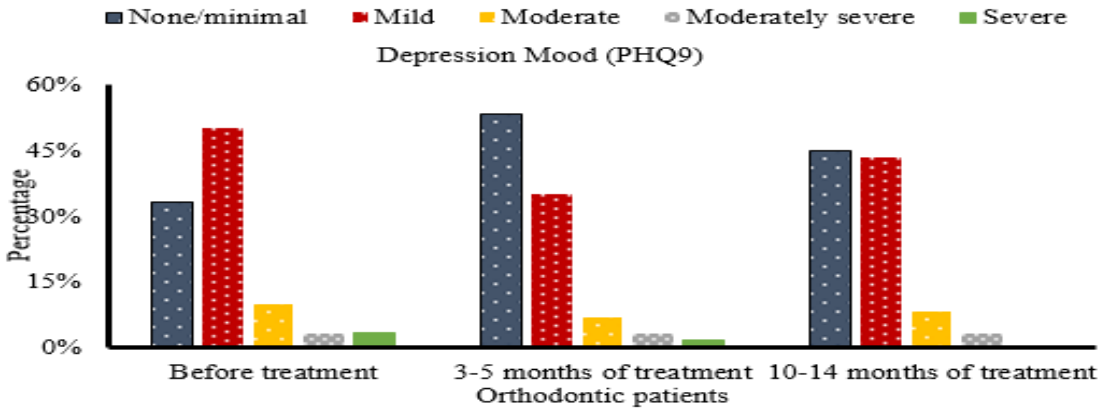

Fig.4: Percentage Related to Depression Mood among Orthodontic Patients

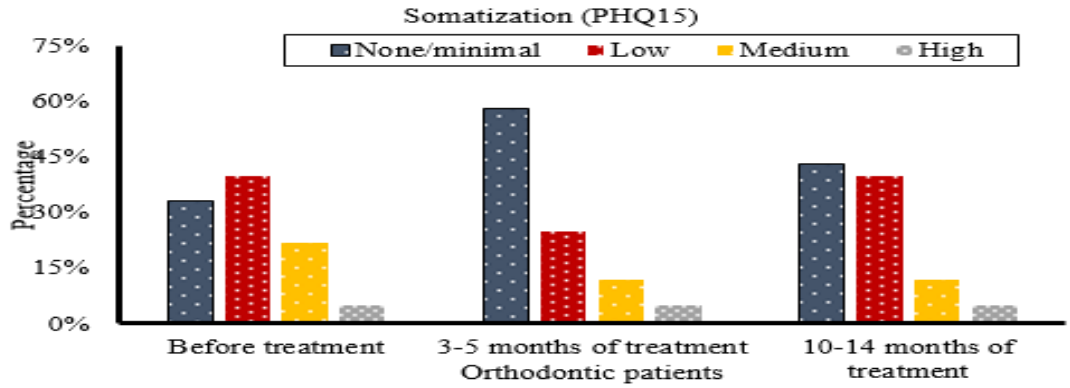

Fig.5: Percentage Related to Somatization Levels among Orthodontic Patients

There were no significant differences between patients before treatment (Control), as compared to patients undergoing active orthodontic treatment for 3-5 months (leveling and alignment stage) and for 10-14 months (finishing stage) regarding risk to develop parafunctional habits (OBC - p=0.769; Fisher Exact test), chronic pain (GCPS- p=0.265; Fisher Exact test), depression levels (PHQ-9, p=0.542; Fisher Exact test) and somatization (PHQ-15, p=0.143; Fisher Exact test).

On the other hand, there was a significant difference in jaw functional limitations (JFLS) among the three groups with respect to: (1) Masticatory limitation (p-value<0.001; Chi Square test); (2) Vertical Mobility Limitation (p-value=0.001; Chi Square test); (3) Verbal and Emotional Expression Limitation (p-value=0.014; Chi Square test); (4) Temporo-Mandibular Joint Problems (p-value<0.001; Chi Square test).

The risk to develop oral parafunctional habits (-p-value=0.325; Fisher Exact test) and tempromandibular disorders (-p-value=0.577; Chi square test) were not significantly different between males and females (-p-value=0.325; Fisher Exact test). The chronic pain associated with disability was elevated in females while the presence of pain with no disability was greater in men (-p-value=0.046; Fisher Exact test). However, the prevalence of depressed mood was significantly elevated in females (63.8%) compared to males (47.7%) (p-value=0.029; Chi square test); similar to somatization status which was significantly elevated in females (64.9%) compared to males (44.2%) (p-value=0.039; Fisher Exact test).

4. DISCUSSION

The role of orthodontic treatment in the etiology of TMD still a subject of discussion between clinicians. From a clinical prospective, a thorough examination of the stomatognathic system is always necessary in order to detect possible TMD signs and symptoms, and to provide basic pain management and support. However, studies following up patients at different phases of orthodontic treatment are lacking, as several studies were only conducted between subjects with or without "previous experience" of orthodontic treatment (Macfarlane TV el al, 2009). Moreover,

a much-diminished role is assigned to dental occlusion as risk factors for TMD, compared to psychological and psychosocial factors (Greenspan JD et al, 2013). Nonetheless, few studies have been published on the prevalence of pain-related impairment, and little is known about the biopsychological frame of pain. Since the etiology lying behind the development of symptoms during orthodontic treatment is still unclear and knowing that occlusal factors and orthodontic treatment seem to be neither a preventive nor a causative factor of TMD, the alterations in the patient's biological stomatognathic and psychological aspects were worth exploring. This study was carried out as a descriptive cross sectional clinical survey based on Diagnostic Criteria for Tempromandibular Disorders (DC/TMD) Axis II. DC/TMD Axis II is a diagnostic tool that provides validated questionnaires to evaluate psychological and psychosocial behavior that have to be handled at therapeutical level. To the best of our knowledge, this is the first study using the DC/TMD to evaluate the prevalence of TMD among orthodontic patients at two phases of active treatment. The prevalence of a condition is highly dependent on the criteria used, its frequency, and its duration. Mild TMD symptoms were the most prevalent category reported by orthodontic patients in this study. This was similar to the study performed by Araòjo, P.V.S. et al, using a structured questionnaire about the use of fixed orthodontic appliances and TMD symptoms linked to emotional tensions, parafunctional habits and articular symptomatology (Araòjo, P.V.S. et al., 2018). On the contrary, the only TMD symptoms elicited by orthodontic patients in this study included masticatory, vertical and verbal and emotional expression jaw limitation. Taken together, with respect to the assessment of axis II findings, our results are in line with expected associations between behavioral functional and psychosocial factors. Based on these observations, this study shows important findings that encourages us to investigate deeper into the TMD-orthodontics relationship. Some authors have reported that parafunctional habits are one of the main factors in the etiology of TMD (Bezerra BP et al., 2012). In a biopsychosocial model, bruxism may trigger the onset of TMD-pain when united with psychosocial disturbance (Manfredini D et al, 2017). When an individual is submitted to an emotional overload, the teeth are clenched, which in turn causes circulatory changes or compression on the pain receptors due to fluid increase in the masticatory muscles.21 Our study showed that only 22.5% of the total orthodontic patients (3-5 months and 10-14 months of treatment) reported higher parafunctional habits almost equal to the control group (21%). This finding proves that orthodontic patients are at a lower risk for developing parafunctional activities and consequently TMD. The GCPS is considered a reliable and valid instrument that measures pain intensity (characteristic pain intensity [CPI]) and consequences of pain (pain-related disability items) during the last 3 months (Von Korff M et al, 1992). The majority of orthodontic patients, at different phases of treatment, reported a low pain intensity without interference in their daily living (GCPS grade I or II) while very few patients reported some pain related disabilities (GCPS grade III or IV). In the year 2010, Manfredini, Borella et al. have shown that the GCPS was not significantly associated with depression in TMD patients, and the author accredited this to the small sample size (Manfredini, Borella et al., 2010). On the contrary, several studies have demonstrated that TMD patients with high levels of pain-related disability measured by Graded Chronic Pain Scale (GCPS) show depressive and somatizing impairements (Kotiranta et al., 2015). Our results confirmed this hypothesis. When dealing with the functional limitations reported in our study, the results show higher self-reported functional limitations among orthodontic patients as compared to the control group. Consequently, this may interfere with the basic jaw functions such as eating, yawning and communication that affect the overall health condition. A possible explanation would be due to patient's worrying about breaking orthodontic brackets during mastication especially during the first 5 months of treatment. Not to forget the use of elastics during the second phase of treatment (finishing phase), which would limit vertical jaw movements. Temporomandibular disorders (TMD) is a multifactorial condition that deals with pathophysiological, social, cultural and psychological components. Psychological factors in TMD situations may be divided into: behavioral symptoms such as bruxism, emotional symptoms such as stress anxiety and depression, and cognitive symptoms with memory-related aspects. Studies have shown that TMD-patients have similar psychological profiles as other chronic musculoskeletal pain disorders (Manfredini et al. 2010). The relationship between TMD and its symptoms (measured by the PHQ9 and PHQ15) were confirmed by the depressive and somatic symptoms found in orthodontic patients against control group. Similar results were presented in literature where a three-year cohort study demonstrated that depression, perceived stress, and mood increased the risk of TMD (Slade GD et al.,

2007).Another three-year cohort study showed that adolescents who experienced somatization and life dissatisfaction had an increased risk of TMD-pain, regardless of gender and the presence of other pain complaints (LeResche L at al., 2007). Likewise, psychological disturbances promote the onset and persistence of dysfunctional TMD pain, regardless of the presence of painful comorbidities (Velly AM et al., 2010). Our study showed that females were prone to higher pain intensities limiting their daily and recreational activities, whereas males were subjected to lower pain intensities without disability. This was similar to the results done in the previous studies by Ferreira et al. (Ferreira et al., 2016), and Graue et al. (Graue et al., 2016). The differences that exist between males and females in the perception, expression, and tolerance of pain were attributed to social and psychological factors (Miller & Newton, 2006). Gender roles have also been aligned with a pain response, with males showing increased tolerance for pain, whereas females accept pain as a normal part of life and are more likely to express it (Myers et al., 2003). This may be due to feminine physiologic uniqueness such as regular hormonal variations, different characteristics of the connective tissue, and muscular structure (Pedroni CR et al., 2003). Moreover, Nilsson et al. indicated that depressive symptoms and somatic complaints co-occurred in girls more than boys with TMD pain (Nilsson et al., 2009). Additionally, it was suggested that psychosocial factors could intensify both pain behavior and the amount of pain felt especially when it becomes more chronic in nature.34 Differences in reaction to stress depend on heredity, sex, and social-natural environment. Hence, the degree of contribution of different factors to TMD may be related to individual differences among people. Our results confirmed these findings in which females were more prone to express depressive and somatic symptoms than males. The etiology of TMD is complex and may not be explained on a cause-and-effect basis (Talic, 2011). TMD has multifactorial etiology and unpredictable nature, emphasizing that active orthodontic treatment does not trigger this disorder (Machado et al., 2010). Scientific evidence points out that the use of orthodontic appliances does not seem to be associated with the beginning, maintenance or evolution of TMD. Cross sectional studies describing TMD-orthodontics relationship concluded that orthodontic intervention did not increase the risk or worsen pre-treatment signs of TMD (Macfarlane et al., 2010).

5. CONCLUSION

Within the confines of this study, our findings highlight the point that active orthodontic treatment is TMD-neutral. However, further prospective studies are needed to evaluate how this evolves over time. Due to the etiological complexity and physiopathology of TMD, signs and symptoms can appear before, during or after orthodontic treatment. Therefore, care should be taken when diagnosing, planning, conducting and finishing any orthodontic case.

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