# Evaluation of occlusal factors in patients with temporomandibular joint disorder

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**Objective:** The aim of this study was to determine the prevalence and the relation between the main occlusal factors and the temporomandibular disorder (TMD).

**Methods:** We analyzed 100 patients (50 diagnosed with TMD and 50 asymptomatic volunteers, control group) through a questionnaire that classified TMD as absent, mild, moderate and severe. Then, an evaluation was made of intraoral occlusal factors: Absence of posterior teeth, wear facets, overjet, overbite, open bite, posterior crossbite, sagittal relationship (Class I, II and III), centric relation discrepancy for maximum intercuspation, anterior guidance and balancing occlusal interference. The $\chi^2$ examined the association between TMD and considered occlusal variables.

**Results:** The prevalence of studied occlusal factors was higher in patients with moderate and severe TMD. Statistically significant results were found on: Absence of five or more posterior teeth, overbite and overjet greater than 5 mm, edge-to-edge bite, posterior crossbite, Class II and III, the absence of effective anterior guide and balancing side interferences.

**Conclusions:** Indeed, it is concluded that there is a relationship between TMD and occlusal factors, however it can not be told to what extent these factors are predisposing, precipitating or perpetuating the disease. Therefore, despite its multifactorial etiology, one can not neglect the occlusal analysis of these patients.

**Keywords:** Dental occlusion. Malocclusion. Temporomandibular joint dysfunction syndrome.

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## INTRODUCTION

The temporomandibular disorder (TMD) is defined as a set of functional and pathological conditions affecting the temporomandibular joint (TMJ), masticatory muscles and tissue adjacent components.[9] It is characterized by several signs and symptoms that include facial muscle and joint pain, limitation and / or mandibular deviation in the trajectory, joint noises, headaches, earaches and pain of cervical origin.[20]

Because of the etiological complexity and variety of signs and symptoms that may represent other pathologies, recognition and differentiation of TMDs is not very clear to the professional. Therefore, routine screening should be combined with the anamnesis and selective clinical examination, for the professional to perform an accurate diagnosis and therefore develop the proper treatment plan.[2] Several diagnostic systems have been used in literature, playing an important role in characterizing and classifying patients with TMD.[4,11]

Although there is not a defined etiology for TMD, functional, structural and psychological factors characterize the multifactorial origin of this dysfunction. Some conditions, such as malocclusion, parafunctional habits, emotional stress, trauma, sleep disorders, postural abnormalities, systemic factors, are present with particular frequency in patients with TMD signs. However, it cannot be stated that these factors are predisposing TMD or are only coincidental.[25]

The occlusion is now treated not only as the ratio of contact between teeth, but as a dynamic, morphological and functional relation between all components of the stomatognathic system, presenting a great influence on chewing, swallowing and speech.[19] There is a huge controversy in literature regarding the association between occlusion and TMD. Some authors have reported high turnout of occlusal factors in signs and symptoms of TMD.[1,19] Others are skeptical about it[6,10,16] and others believe that occlusion plays a limited role, but it cannot be underestimated.[3,8,12,14,17,18,22,23,26,27]

Taking all together, many studies have found relationship between TMD and occlusal changes: Premature occlusal contacts,[19,20] no anterior guide,[19,27] balancing side interference,[12,19] sagittal relation Class II,[17,19,27] and Class III,[7,13,19] anterior open bite,[14,19,25,26] crossbite,[3,13,14,19,26] overjet / deep overbite greater than 5 mm,[14,18,26] great centric relation discrepancy (CR) to usual maximum intercuspation(MI) greater than 2 to 4 mm[3,12,14,19,26] and 5 or more missing posterior teeth.[14,19,26]

The aim of this present study was to verify the prevalence and relationship between TMD and several occlusal factors.

## MATERIAL AND METHODS

This research was submitted and approved by the Ethics Committee in Research of Federal University of Sergipe - CEP / UFS University Hospital (No. CAAE - 0053.0.107.000-08).

One hundred patients from the Department of Operative Dentistry, Federal University of Sergipe, were evaluated. Fifty patients had TMD and the control group was composed by 50 volunteers with no TMD symptoms. In both groups, it was adopted the following exclusion criteria: Previous orthodontic treatment and/or orthopedic and prosthetic rehabilitation treatment. All patients signed a consent form.

A single investigator was used to collect the data from the clinical records. Initially, the patient underwent an interview (anamnesis) using the questionnaire proposed by Fonseca et al[4] composed of 10 questions related to the signs and symptoms of TMD, such as the presence of TMJ sounds, impaired mouth movement, pain and muscle fatigue during chewing, headaches, neck pain, earaches or pain in the region of the joints. For each question, the possible responses were"yes", "sometimes" and "no", which are assigned the values "10", "5" and "0", respectively. For the questionnaire analysis, "yes", "sometimes" and "no" were added up together. Subjects were classified according to the value found in TMD: "Absent," "Mild," "Moderate" and "Severe" (ranging from "0-15", "20-40", "45-65" and "70-100", respectively). For inclusion in the control group they were asked to present the classification of TMD "absent" in range "0-15".

Next, it was performed an intraoral clinical examination for evaluation of occlusal characteristics using a second form:

A) Number of teeth with wear facets.

B) Number of posterior missing teeth (excluding third molars).
C) Overjet and overbite measured with the use of a millimeter ruler and using a dry point compass. Edge-to-edge bite were considered in cases of no overjet and overbite. The negative overjet was obtained by the distance between the end of the incisal edge of lower incisors and the anterior surface of the maxillary incisor, measured horizontally.
D) Presence of anterior open bite (negative overbite).
E) Presence of posterior crossbite (unilateral or bilateral).
F) Centric relation (CR) discrepancy to maximum intercuspation (MHI), obtaining the position of CR with the technique of manipulating the tip of the chin ( unforced guide) of the patient and comparing the position of MHI, measuring the discrepancy between these positions:
G) Classes I, II or III malocclusion.
H) The type of anterior guide. The patient was asked to do the laterality move, right and left, (absent, canine, total or partial group function) and protusive movement (absent or present) to the top position.
I) Presence of non-working side interference during laterality and disarticulation of the posterior teeth in protrusion, verified with cellophane strip on the posterior teeth.

The frequencies of the different variables were expressed as percentage and to obtain the results it was applied the $\chi^2$ test examining the association between TMD and the occlusal variables. The implementation of graphics and statistical testing were performed using the softwares Microsoft Office Excel 2007 and SPSS (Statistical Package for Social Sciences) version 13.0 for Windows.

## RESULTS

The distribution of the sample regarding gender and age can be observed in Figures 1 and 2, respectively. The positive responses of the anamnestic questionnaire for the diagnosis of TMD can be found in Figure 3. Regarding Fonseca et al[4] index, adding up the scores of answers (10 answer "yes", 5 "sometimes" and 0 "no") to the ten questions in the anamnestic questionnaire came to the classification in symptomatic group that 36% of the sample had moderate TMD ("45-65" scores) and 64% severe ("70-100"). In the control group all patients showed the classification of absent TMD ("0-15").

In the TMD group, 32% had posterior crossbite (20% unilateral and 12% bilateral), 8% open bite, 18% overbite and 10% overjet greater than 5 mm, about 38% edge-to-edge bite, 22% did not have overjet, overbite or edge-to-edge due to the absence of incisors and 62% absence of 5 or more teeth. The number of teeth with dental wear found was 20% for 1 to 4 teeth, 12% for 5 to 10 teeth and 18% with more than 10 worn teeth. Considering the sagittal relation, 42% were Class I, 26% Class II and 32% Class III. The discrepancy between centric relation (CR) and maximum intercuspation (MHI) was 68% for 0 to 2 mm, 30% for 2 to 4 mm and 2% for greater than 4 mm. Figure 4 shows the distribution of main occlusal factors studied, both in the TMD group as well as in the control group.

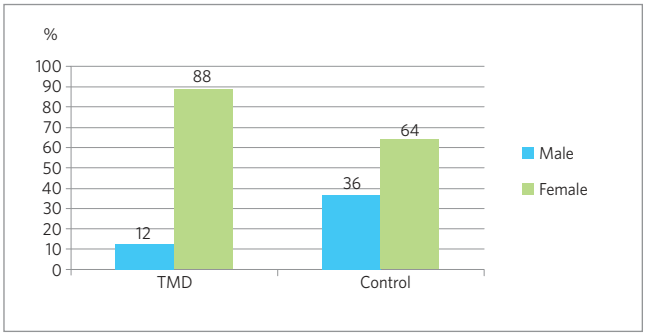


**Figure 1** - Distribution of the sample according to gender.

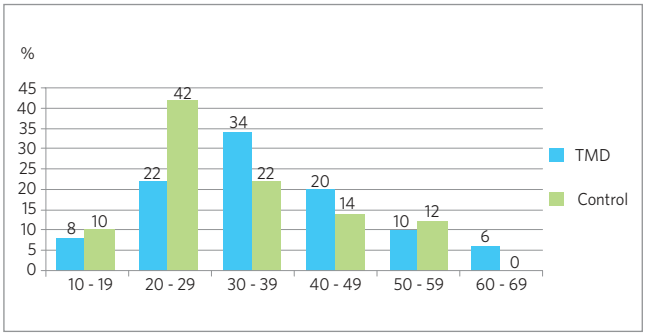


**Figure 2** - Distribution of the sample according to age.

During the lateral mandibular movement in TMD patients, it was observed high percentage of group function, partial (46% right and 42% left) and total (10% right and 6% left), with a low frequency of canine guide (14% right and 16% left). The lateral guide was absent due to tooth loss, being 30% on the right and 36% on the left side. Balancing side interferences were found in 78% of TMD patients (34% unilateral and 44% bilateral). During the protusive movement 74% had malocclusion of the posterior teeth guided by anterior teeth. The summarized data related to the functional aspect of occlusal anterior guidance in both groups can be observed in Figure 5.

The $\chi^2$ test detected a statistically significant association ($p < 0.05$) for absence of five or more posterior teeth, overbite and overjet greater than 5 mm, edge-to-edge bite, posterior crossbite (uni and bilateral), Class II and III, different types of anterior guide and balancing side interference.

## DISCUSSION

This study evaluated the prevalence and relation of several occlusal factors in TMD patients diagnosed. More than a half of patients (54%) were 30 to 49 years old with a strong female predominance (88%), which corroborates with other studies.[9,11,13,20] According Luther,[13] the high incidence in women may be related to hormonal changes that occur at this stage of life. A greater concentration of women (64%) was also observed in the control group.

Regarding the questionnaire, it is noticed that about 70 to 80% of TMD patients showed positive responses to TMJ sounds, muscle discomfort or pain while chewing, headaches and pain in the cervical

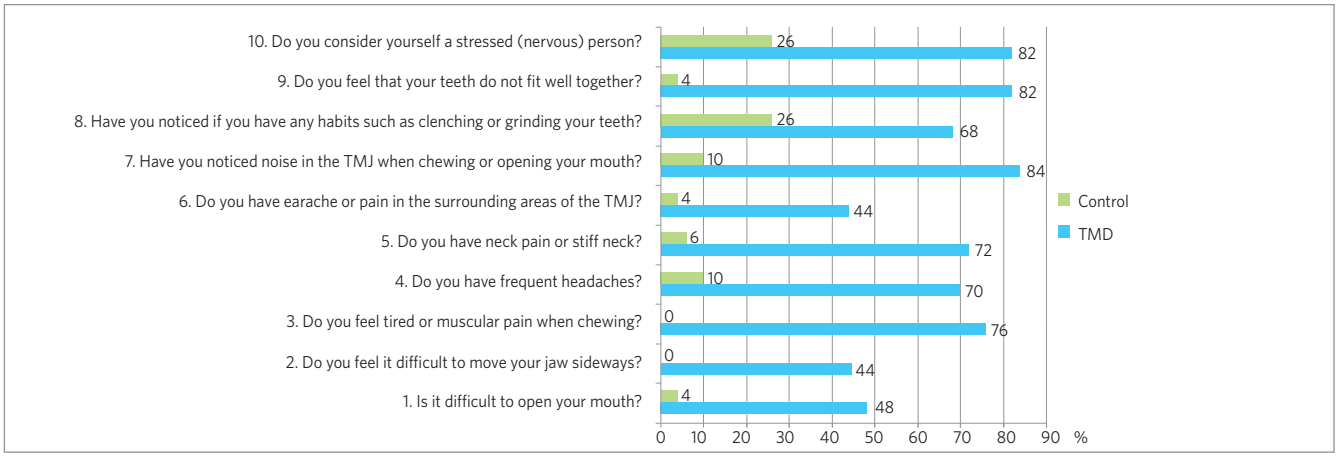


**Figure 3** - Distribution of positive responses to the questionnaire.

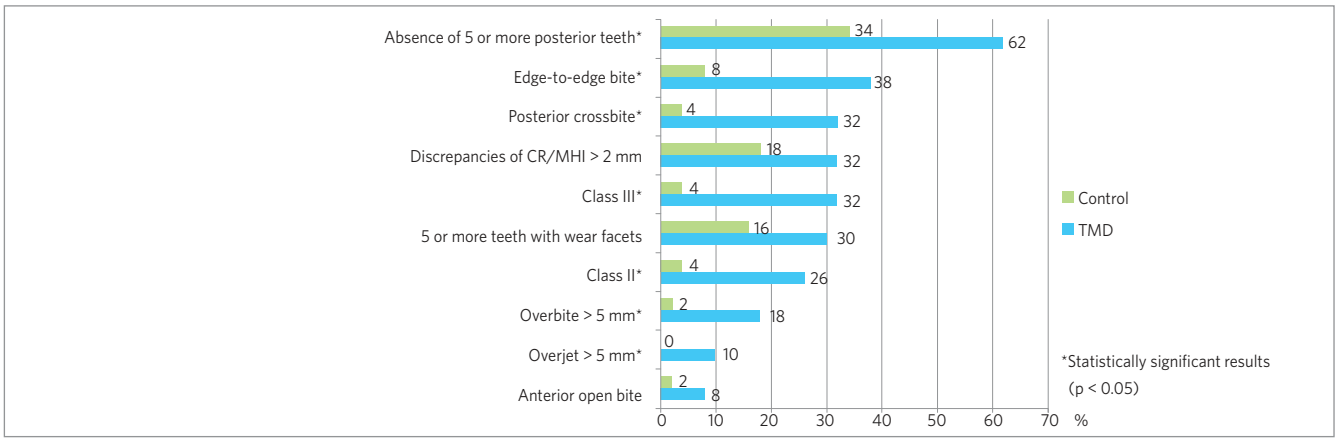


**Figure 4** - Distribution of occlusal factors.

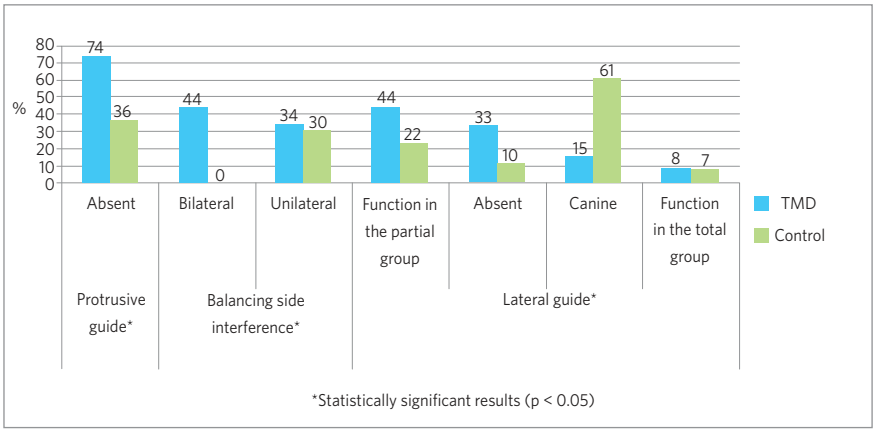


**Figure 5** - Distribution of functional occlusal factors of the anterior guide.

region, agreeing with work related to the main signals and symptoms of patients with TMD.[7,11,20] Signs and symptoms of TMD can occur in healthy people[2,14] as found in the control group in this study, that despite the classification as "absent" by Fonseca et al[4] index, it is observed the presence mainly of headache (10%) and joint noise (10%).

The TMJ joint noises are frequent, even in an asymptomatic population, while the absence of joint noise cannot be used as a rule for articulation normality.[2,7,14] One must perform a careful clinical examination of signs and symptoms of TMD, before starting the orthodontic treatment, for the patient to be alerted in case of presence of these signs and / or symptoms.

The emotional factor was also directly related to TMD in this study, since 82% of patients reported some type of stress.[12,25,28] Stress in the control group also showed a significant participation (26%), showing its influence on society today. Both stress and occlusion have different involvement in the occurrence of TMD, depending on the adaptive capacity of the patient, explained by different degrees of physiological tolerance. Emotional stress can cause muscle hyperactivity, characterizing the so-called bruxism or clenching, so when an emotional component is associated with a physical factor, such as occlusal changes, stress relief by the stomatognathic system produces symptoms of pain and dysfunction.[12,28]

The habit of grinding and / or clenching was present in 26% of the control group, and 68% in the TMD sample, showing the important relationship between these habits and TMD as observed in previous studies.[5,28,29] The high incidence of these habits clinically reflected in the presence of 5 or more teeth with wear facets, which were observed in 16% from control and 30% in patients with dysfunction, corroborating with other studies[21,29] that also observed an association between TMD, dental wear and the habit of grinding or clenching.

The most prevalent occlusion factor in patients with TMD was the absence of 5 or more posterior teeth observed in 62% of the sample. Due to the adaptive process of the TMJ before the functional changes related to tooth loss, several studies[14,26,30] report that the loss of posterior teeth is associated with joint changes, particularly increasing the risk of cracking, and disc displacement. This was also the most prevalent occlusal factor in asymptomatic patients, although with a lower percentage (34%).

The occlusal instability caused by the lost of posterior teeth may cause TMD since the occlusal changes, muscle changes and joint changes exceed the adaptive threshold of the stomatognathic system.[14.26] Making prostheses to replace missing teeth in symptomatic patients is not the ideal treatment, because in these cases joint changes have already occurred, thus requiring a complex multidisciplinary rehabilitation treatment to reestablish the physiological function. The early prosthetic rehabilitation treatment in asymptomatic patients may be indicated in order to prevent the occlusal collapse and, consequently, to reduce the risk of future joint problems.

Previous studies[3,13,14,15,26] reported an association between TMD and crossbite. In this study, 32% of

the patients had TMD and only 4% were from the control group. The crossbite generates an interference with the contact of posterior teeth, displacing the mandible to a more effective contact. Thus, this abnormal movement of the mandible may have long-term effects on the growth and development of teeth and jaws, creating greater pressure on the mandibular muscles and joints.[13]

For some authors,[14,26] patients with crossbite have increased risk to develop TMD and, in these cases, early orthodontic treatment would help to reduce the adaptive demands on the masticatory system, preventing the occurrence of TMD signs and symptoms in the future. On the other hand, the orthodontic treatment in adults to prevent the development of TMD is probably not guaranteed because the bone adaptation has already occurred. The literature is very controversial and now it can not be scientifically proved that the orthodontic treatment alone, prevents, cure, or causes TMD, because its etiology is multifactorial and complex, i.e., limiting several functional, structural and psychological factors such as: emotional stress, trauma, sleep disorders, postural abnormalities, systemic factors, muscle hyperactivity and / or TMJ overload, among others, may trigger this disorder.

In the study by John et al[10] there was no relationship between TMD and high values of overbite / overjet (greater than 5 mm), which are compatible with the normal function of the masticatory muscles and TMJ. In the healthy individuals of this study, there was no occurrence of high values of overbite and/or overjet (2% and 0%), respectively. However many studies[14,18,26] corroborate that overjet and/or overbite greater than 5 mm are related to the increasing risk of developing TMD, being found in 10% and 18% respectively, of patients with dysfunction in this study.

Despite few reports in literature[3,6] regarding the association between TMD and edge-to-edge bite, it is observed a relatively high frequency of 38% of the sample with TMD and only 8% of asymptomatic patients. For some authors[15,26] minimal overjet / overbite are associated with TMJ problems.

Some studies[14,26] reported an association between the anterior open bite and TMD, but a low frequency was found in 8% of the TMD group and 2% of the control group. This occlusal feature causes the absence of the anterior guide and the presence of posterior interference.[14,26] According to some authors,[14] the aim of early orthodontic treatment in these patients is to improve the function of the stomatognathic system and to avoid adaptive changes of the TMJ, preventing the occurrence of TMD symptoms.

It is noteworthy that 22% of the sample with dysfunction showed no relation between upper and lower incisors due to the absence of these teeth. When it was added this percentage (22%) with anterior open bite (8%), overjet and/or overbite greater than 5 mm (20%), edge-to-edge bite (38%), it was observed that 88% of patients with TMD present changes in the relation between the incisors.

This high prevalence of problems in the upper and lower incisors relationship reflected directly on the anterior guide of patients, which is considered essential for the health of the stomatognathic system. In the effective anterior guide it occurs the disocclusion of posterior teeth guided by harmonic contact of the lingual surfaces of maxillary anterior teeth and maxillary anterior incisors during lateral movements and protrusion.[19]

However, during protusive movement, 74% of surveyed patients with TMD had no efficient guide, different from that observed in the control group, in which showed 64% efficiency of this guide. In the lateral movement of the patients with TMD, there is a predominance of group function (44% partial and 8% total), besides that 30% had no guide due to lack of teeth. The canine guide considered ideal was found in 61% of the control group and in only 15% of the sample with TMD, and the absence of canine guide is considered a risk factor for the development of TMD.[20,24,27]

The effect of disarticulation of the posterior teeth in the treatment of TMD symptoms was found in other studies,[20,24,27] reporting a decrease of symptoms after restoring the anterior guide. During the lateral movement it was observed that there is interference on the non-working or balancing side in 78% of the sample with TMD (34% unilateral and 44% bilateral).

According to Landi et al,[12] non-working side interferences produces significant changes in muscle activity on the side of the interference, promoting muscle contraction. In this study, 70% of asymptomatic patients did not have this type of interference.

About 58% of TMD patients had problems regarding the sagittal relationship (26% Class II and 32% Class III ), as reported by other authors.[8,13] Individuals with Class II malocclusion have great freedom of mandible movement, unlike Class III mandibular movement that is limited.[17] Some studies[17,26] indicate a greater participation of Class II in temporomandibular disorders considered an important risk factor for these patients. The Class I relation was the most frequent in 42% of the sample with TMD and in control groups with 92%.

Regarding the discrepancy between the positions of CR and MHI, deviations greater than 2 mm were found in 32% of patients with TMD. Discrepancies from 0 to 2 mm are considered normal[22] and in this study they were found in 82% of asymptomatic patients and in 68% of TMD patients showing that this discrepancy was common both in the control group as in patients with TMD, so there is direct relation between this occlusal factor with TMD.

## CONCLUSION

The relation between occlusal factors, orthodontics and TMD remains controversial, and there is not a consensus in literature yet. In this study, from the observed variables, it was found a statistically significant association for five or more missing posterior teeth, overbite and overjet greater than 5 mm, edge-to-edge bite, posterior crossbite, Class II and III, different types of anterior guide and balancing side interference.

Thus, due to the multifactorial etiology of TMD, it can not exactly be defined the extent to which these changes can actually be considered predisposing, triggering or perpetuating factors of this disease. However it can not overlooked the importance of a careful history and evaluation of the entire stomatognathic system combined with occlusal analysis, essential for the diagnosis and treatment of patients, especially with signs and symptoms of TMD, as this study found a high prevalence of occlusal factors, along with stress and habits of clenching or grinding.

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