

# Relationship between abnormal horizontal or vertical dental overlap and temporomandibular disorders

## Relação de trespasse vertical e horizontal com desordens temporomandibulares

### Abstract

**Purpose:** This study investigated if abnormal vertical (overbite) and/or horizontal (overjet) dental overlap are more prevalent in adult subjects with clinical signs of temporomandibular disorders (TMD).

**Methods:** Case-control design. The sample comprised 103 subjects, males and females from 19 to 54 year-old, which were divided into two groups: Group 1 (control) without TMD (n=52) and Group 2 (cases) with TMD (n=51). Inclusion criteria for Group 2 were based on axis I of the RDC/TMD protocol. Two calibrated examiners (Cohen kappa = 0.85) performed the clinical examination to collect data on occlusion and TMD. Data were analyzed by Chi-square tests.

**Results:** Overbite mean values were 3.4 mm (control group) and 2.5 mm (cases group). Abnormal overbite was found in 26 subjects (50%) of the control group and 16 (31%) in the cases group ( $P=0.054$ ). Overjet mean values were 2.4 mm and 2.0 mm for the control and cases groups, respectively. Abnormal overjet was found in 44 (85%) subjects of the control group and 44 (86%) of the cases group ( $P=0.811$ ). No significant overall association was found between the tested occlusal variables and TMD ( $P=0.585$ ).

**Conclusion:** Overbite and overjet were not associated with TMD in this sample.

**Key words:** TMD; occlusion; overjet; overbite

### Resumo

**Objetivo:** Este estudo investigou se anormalidades de trespasse vertical (*overbite*) e/ou horizontal (*overjet*) são mais prevalentes em sujeitos adultos com manifestações clínicas de desordens temporomandibulares (DTM).

**Metodologia:** Desenho de caso-controle. A amostra consistiu de 103 sujeitos, com idades de 19 a 54 anos, que foram divididos em dois grupos: Grupo 1 (controle) sem DTM (n=52) e Grupo 2 (casos) com DTM (n=51). Os critérios de inclusão para o Grupo 2 basearam-se no eixo I do protocolo RDC/TMD. Dois examinadores calibrados (Cohen kappa=0.85) realizaram o exame clínico para coleta dos dados de oclusão e de DTM. Data were analyzed by Chi-square tests.

**Resultados:** Os valores médios de *overbite* foram 3,4 mm (controle) e 2,5 mm (casos). *Overbite* anormal foi mensurado em 26 sujeitos (50%) do grupo controle e 16 (31%) no grupo casos ( $P=0,054$ ). Os valores médios de *overjet* foram de 2,4 mm e 2,0 mm para os grupos controle e casos, respectivamente. Observou-se *overjet* anormal em 44 (85%) sujeitos do grupo controle e 44 (86%) dos casos ( $P=0,811$ ). Nenhuma associação significativa foi observada entre as variáveis oclusais testadas e DTM ( $P=0,585$ ).

**Conclusão:** *Overbite* e *overjet* não foram associadas a DTM nesta amostra.

**Palavras-chave:** Disfunção; oclusão; trespasse horizontal; trespasse vertical

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## Introduction

The stomatognathic system (SS) is composed of different anatomical structures (temporomandibular joints, muscles, teeth, periodontium, ligaments, ears, etc.), which have a very complex interaction to optimize the system performance during function, *i.e.*, maximum work production with minimum energy consumption. SS functions comprise mastication, swallowing, phonation, breathing, sensations, and communication of feelings through mimics (1). As the SS anatomical components are functionally linked to each other, the alteration or dysfunction of one or several elements could imbalance the entire system (2).

When normal function is affected by a local or systemic problem that surpasses the physiologic tolerance of each subject, a response is triggered with a large variety of signs and symptoms characterizing the Syndrome of Dysfunction of the Stomatognathic System (SDSS) or Temporomandibular Disorder (TMD) (3). TMD is a multifactorial pathology with articular, auditive, cranial, nasopharynx, neurologic, and psychological signs and symptoms (4). Predisposing factors can be structural, psychological, or multifactorial, and would be necessary for the onset of dysfunction.

Occlusion is important for the balance of the stomatognathic system and is traditionally regarded as a potential determinant in TMD etiology (5). Occlusal alterations have been considered either predisposing or causal factors of TMD (6). However, recently Gesch et al. (7) reported the findings of a large longitudinal study with 7,008 subjects between 20 and 79 year-old, which were examined following the guidelines of the Academy of Orofacial Pain. Those authors found that occlusal factors were not associated with TMD symptoms, and normal occlusion had similar prevalence in subjects with and without TMD.

Vertical overlap or overbite has been defined as the extension of the maxillary teeth over the mandibular teeth, in the vertical plane, when the antagonist teeth are in maximal intercuspation. Therefore, in normal occlusion, the incisal edges of the maxillary incisors lap over up to one third of the mandibular incisors crown. When this interincisal distance increases to establish an abnormal condition, there is a severe vertical overlap (3). Horizontal overlap (overjet) has been defined as the projection of maxillary teeth beyond their antagonists in the horizontal plane when the teeth are in maximal intercuspation (3). Severe overjet and overbite would be responsible for the increase of load on the masticatory muscles (8), but the direct association between TMD and abnormal occlusion remains controversial. Several common therapeutic procedures have been based on this presumed connection, such as occlusal splints, occlusal adjustment, restorative procedures, and orthodontic treatment, yet no conclusive evidence of the real impact of occlusion on TMD is still available.

This case-control study sought to investigate if abnormal overbite and/or overjet are more prevalent in adult subjects with clinical manifestations of TMD.

## Methods

The research protocol was approved by the Ethical Committee on Research of the Federal University of Juiz de Fora (127/2008), and all subjects signed an informed consent form. A non-random sample was selected among the patients undergoing treatment the dental clinics of the School of Dentistry of the Federal University of Juiz de Fora, Juiz de Fora, MG, Brazil. Sample size calculation for a confidence level of 95% yielded a minimum number of 96 subjects. The sample comprised 103 volunteer subjects, with age ranging from 19 to 54 year-old, which were divided into two groups: Group 1 (control) without TMD (n=52) and Group 2 (cases) with TMD (n=51).

For Group 2 inclusion criteria were based on TMD diagnosis according to the axis I of the Research Diagnostic Criteria for Temporomandibular Dysfunctions (RDC/TMD) (9). The original protocol was modified because the evaluation of the lateral pterygoid muscle was discarded due to the impossibility of its palpation (10). Exclusion criteria comprised past users of orthodontic appliances, complete or partial removable prosthesis; absence of maxillary and mandibular incisors; and absence of more than two posterior teeth (bicuspid and/or molars) in each hemi-arch, except for the third molars and bicuspid extracted due to orthodontic reasons.

The research protocol included anamnesis and clinical examination for occlusal evaluation and TMD diagnosis by two examiners who were previously calibrated (Cohen kappa=0.85). During clinical examination, the subject was positioned in supine position with the examiner at 12-hour position. The palpation of extraoral muscles was performed by using bi-digital pressure with an approximately pressure of 1 kgf and direct visual control of the patient responses. The pain reported by the subject was scored (11): 0 – absence of pain or presence of small discomfort; 1 – mild pain; 2 – moderate pain; and 3 – severe pain. Articular problems were assessed by TMJ palpation with a 0.5 kgf finger pressure (11).

The measurement of vertical and horizontal overlap was performed with the subject sat on the dental chair, with the head in orthostatic position and the Frankfurt plane parallel to the ground. The subject was asked to occlude in maximal intercuspation, where the isometric contraction intensity is maximal in order to standardize the measurements (12). To measure overbite, the vertical overlap of the incisal edges of the maxillary central incisors was marked on the buccal surface of the mandibular incisors. The vertical distance between the incisal edges of the maxillary and mandibular incisors was recorded in millimeters by means of a dry-point compass and a ruler (11). Overbite was considered normal when the interincisal distance was larger than 0.5 mm (13) and smaller than 4 mm (14). Overjet was recorded in millimeters by using a customized ruler to measure the distance between the buccal surface of the mandibular central incisor and the incisal edge of the maxillary central incisor (11). Overjet value was considered

normal when its measure was positive and smaller than 4 mm (7). Data were analyzed by descriptive statistics and test and control groups were compared by using Pearson's chi-square tests at the level of significance of 5%.

## Results

The sample of 103 subjects had a mean age of 25.5 year-old for the control group and 25.9 year-old for the cases group. The cases group had more females subjects than the control group (78 and 54%, respectively) ( $P=0.008$ ).

**Table 1.** Distribution of the control and cases subjects according to gender.

Group	Gender		Total
	Male	Female	
Control	24 (46%)	28 (54%)	52
Cases	11 (22%)	40 (78%)	51

Table 2 displays the distribution of subjects in the control and cases groups as a function of normal/abnormal overbite and overjet. The mean value of overbite was 3.4 mm for the control group and 2.5 mm for the case group. Abnormal overbite was found in 26 subjects (50%) of the control group and 16 (31%) in cases group ( $P=0.054$ ). In relation to overjet, the mean values were 2.4 mm and 2.0 mm for the control and cases groups, respectively. Abnormal overjet was found in 44 (85%) subjects of the control group and 44 (86%) of the cases group, with no statistical difference between groups ( $P=0.811$ ). No significant overall association was found between the tested occlusal variables and TMD ( $P=0.585$ ).

**Table 2.** Distribution of the control and cases subjects as a function of normal and abnormal values of vertical (overbite) and horizontal (overjet) overlap.

Group	Overbite (mm)		Overjet (mm)		Total
	Normal 0.5 < x < 4	Abnormal* x ≤ 0.5 ; x ≥ 4	Normal 0 < x < 4	Abnormal† x ≥ 4	
Control	26 (50%)	26 (50%)	8 (15%)	44 (85%)	52
Cases	35 (69%)	16 (31%)	7 (14%)	44 (86%)	51

\* Comparison of abnormal overbite between control and cases groups ( $P=0.054$ ).

† Comparison of abnormal overjet between control and cases groups ( $P=0.811$ ).

## Discussion

At present it is still controversial the existence of an association between abnormal vertical and horizontal overlap (overbite and overjet) and TMD, as well as the cut-off values to classify the severity of these abnormal occlusal conditions. Several studies showed contradictory results due to differences in methods and target populations. TMD has been assessed by using a variety of different diagnostic approaches. In 1992, Dworkin and Le Resche (9) developed the Research Diagnostic Criteria for Tempo-

mandibular Disorders (RDC/TMD), a clinical protocol used in the present study to standardize the clinical examination for TMD data collection. The RDC/TMD has been widely used in different settings to investigate TMD (8,16,17), but others used the guidelines of the American Academy of Orofacial Pain (7,15,18), the Helkimo's classification index (13), or other criteria such as the Gutowski (12).

Axis-I RDC/TMD protocol was adopted to diagnose TMD because it has clearly established operational definitions, allowing the precise measurement of the main clinical variables, such as pain during palpation, presence of articular sounds etc (4); proved to be reliable for clinical measurement, and has been validated in several languages (19). The axis II was not evaluated in the present study because it comprises the psychosocial assessment of the patient, which was not within the scope of this research.

The demographics of the study sample followed the standards found in the literature. The present TMD cases group had a mean age of 25 year-old, which is in agreement with Teixeira et al. (6), who found a higher frequency of patients with TMD in subjects aged from 20 to 29 year-old. Furthermore, Okeson (3) stated that subjects in the range of 20 to 40 year-old have higher prevalence of TMD than in other age-groups. In relation to gender, the percentage of women in the cases groups was 78%, which corroborates previous findings of higher prevalence of TMD in females (4,6,11,15,20).

TMD etiology has been considered multifactorial with no clear understanding of the role of specific etiologic agents, but a number of contributing factors are assumed to predispose, initiate, and/or perpetuate the condition. The role of occlusion in the etiology of TMD has been topic of continuous controversies in the literature. Some authors found that occlusion was the most important etiologic factor for TMD (5,12), while others excluded it (7,14,17).

These contradictory findings may be explained by the different samples evaluated (15), particularly in relation to age and gender (22).

Among occlusal factors, severe overbite and overjet have been claimed to influence TMD development (3,23). Teixeira et al. (6) found that an overbite larger than 2 mm was significantly associated with mild symptoms of TMD, corresponding to the presence of articular sounds and

fatigue sensation of the masticatory muscles. Severe overbite could lead the mandible to a retruded position and would predispose the onset of TMD signs and symptoms as shown by Celic and Jerolimov (12), who found that an overbite equal or larger than 5 mm was related to muscle disorders and disc displacement with reduction. However, others did not find any correlation between TMD and abnormal overbite (14,16,21), and some researchers even stated that a large range of overbite could be compatible with the SS normal function (8,17). In the present study, abnormal overbite was found in 26 subjects (50%) of the control group and 16 (24%) in the cases group, which could be considered

marginally significant ( $P=0.054$ ). As the control group had more subjects with abnormal overbite than the cases group, these results suggest that overbite is not related to TMD.

Among several occlusal parameters, Al-Hadi (24) stated that overjet has been more prevalent in patients with TMD. Overjet equal or larger than 4 mm could be related to intrarticular disorders, and values above 5 mm could predispose to muscle disorders and disc displacement with reduction (12). However, in this present study no association was found between overjet and TMD ( $P=0.811$ ), which is in agreement with Selaimen et al. (18), who found that overjet was similar in subjects with and without TMD. Besides, other studies (14-17) did not find any significant correlation between overjet and TMD. John et al. (8) also had demonstrated that severe overbite and overjet were compatible with the normal function of the masticatory muscles.

In general, the present study also found no significant overall association between overbite and overjet and TMD ( $P=0.585$ ). Although this study has limitations of sampling to allow a broad inference of results to the entire TMD population, besides the impossibility to assess causal relationships with the chosen case-control design, the present findings do not support the indication of clinical invasive procedures to prevent or treat TMD by modifying vertical or horizontal overlap with restorative, surgical, or orthodontic procedures without a detailed analysis of the individual case.

## Conclusions

Based on the methodology used and the results found, it can be concluded that no significant association was found between TMD and vertical and horizontal overlap.

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