

The Role of Occlusal Factor in the Etiology of Temporomandibular Dysfunction

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SUMMARY

Introduction The influence of occlusal condition at the onset of temporomandibular disorders (TMD) has been strongly debated for many years and still is the source of controversy. Up to the eighties in the last century, the occlusal factors such as the presence of uncured malocclusions, discrepancies between intercuspal position and retruded contact position greater than two millimeters, retrusive and nonworking side interferences and loss of posterior teeth were considered to be the primary causes of TMD.

Objective The aim of this study was to estimate the role of occlusal factor in the etiology of craniomandibular dysfunction and therapeutic effects of irreversible occlusal therapy (occlusal equilibration) in patients with TMD.

Methods In the investigation we studied a group of 200 men and women. The average age of the selected patients was between 18 and 25 years. The purpose of TMD signs and symptoms was confirmed in every patient using a special functional analysis and evaluating the craniomandibular index (CMI) according to Friction and Schiffman. The value of craniomandibular index was determined in the group of 15 patients with signs and symptoms of temporomandibular dysfunction. In the study groups occlusal equilibration (selective grinding) was performed according to Okeson using the central position of the mandible as the referent position in the occlusal therapy. The value of CMI was determined before and 30 days after occlusal equilibration.

Results The results of this study confirmed the significant reduction in the signs and symptoms of TMD after occlusal equilibration. The statistical elaboration of the differences between the values of CMI I (before treatment) and CMI II (30 days after treatment) revealed highly significant differences. The CMI I values in the group ranged between 0.076 and 0.346 with the mean value of 0.188 ± 0.082 . The values of CMI II ranged between 0.038 and 0.19 with the mean value of 0.038 ± 0.053 .

Conclusion The study conformed the validity of irreversible occlusal therapy (selective grinding) in patients with TMD.

Keywords: Temporomandibular disorders; occlusal interferences; occlusal equilibration

INTRODUCTION

The etiology of temporomandibular disorders (TMD) is highly complex. It has not been cleared yet which factors may be classified as etiological (causative) or consequential [1-4].

A number of authors reported the presence of occlusal disharmonies between the retruded contact position and intercuspal position, as well as balance side disorders that may be correlated to temporomandibular dysfunctions [5-9].

Investigations carried out by Posselt [10] indicated that occlusal interference tended to occur in 81% of the subjects with TMD.

Investigating the correlation between the occlusion and signs and symptoms of TMD, Butler [11] found obstacles on the retruded contact position (RCP) and intercuspal position (ICP) pathways in 71% of subjects, balance side interference in 58%, and protrusion-associated interference in 32% of the subjects.

Studies carried out by Helkimo [12] indicated that contacts on the mediotrusive side tended to occur in 61% of the subjects. However, findings on the presence of occlusal interference on the mediotrusive side reported by other authors differed significantly from the above-mentioned. Thus, Graham et al. indicated that occlusal interference was present on the mediotrusive side in 10% of subjects with TMD [13].

Studies carried out by Mohlin and Koop [14] reported presence of occlusal interferences in 13% of cases on the mediotrusive side, while premature contacts in the RCP occurred in 68% of the subjects. They also reported that mediotrusive side interferences are most commonly found in the molar region (44%). They have also concluded that occlusal factors were important in the development of TMD.

Ingervall et al. [15] reported that premature contacts in the RCP were found in 42% of the subjects, balance side interferences in 8%, and premature contact on the working side in 20% of the subjects, while protrusion-related defects occurred in 8% of the subjects. They also reported occlusal interferences as a possible cause of TMD.

Investigating the effects of occlusion on TMD onset in adult population, De Laat and Van Steenberghe [16] found one or more signs and symptoms of craniomandibular disorders in 88% of the subjects.

Analyzing the occlusal factors in these subjects (number of teeth, size of vertical and horizontal overlap, presence of tooth wear facets, localization of occlusal contacts, evidencing of interference between the RCP and ICP, balance side interferences, mandibular guidance types, etc.) the author found that patients with evidenced bruxism showed greater wearing of tooth substance, as well as that they had group guidance and prominent contacts in the premolar and molar

regions in maximum intercuspation. Muscle hyperactivity that could lead to dysfunctions tended to occur frequently in these patients. Mandibular deviation in the course of mouth opening occurred in patients with a large distance between centric relation position and centric occlusion position. Onset of sounds and crepitations in TMD was common in all patients with a small number of remaining teeth. However the correlation between the number of the remaining teeth and TMD was not established. De Laat Van Steenberghe [16] found a certain correlation between the occlusal factors and signs and symptoms of temporomandibular dysfunctions. However, they stressed that occlusal factors alone did not lead to TMD.

Comparative analysis carried out in individuals with evident occlusal interferences and individuals free of occlusal discrepancy are not suggestive of the influence of occlusion on the development of TMD. The conclusions drawn in these studies did not offer the answer to the question which disorder is the important prerequisite for the development of TMD [17].

There are some evidences supporting the idea that increased TMJ loading as a result of support provided by molars enhances the signs and symptoms of TMD, including structural bone changes [17].

Tooth loss may be one of the important factors contributing to the development of TMD, particularly the loss of the first upper premolar. Studies carried out by Oginni et al. [18] pointed out at the direct association between premolar loss and the onset of TMD.

Tooth loss is recognized as a predisposing factor for the onset of dysfunctions. However, the causative relation has not been quite clear [18, 19]. The authors believe that tooth loss leads to changed muscle function which, in turn, leads to TMD syndrome. Kirverskari offered two explanations for the loss of the first premolar and its correlation with the onset of dysfunctions: to begin with, a premature contact on the first premolar upon mouth closing and disproportional pressure on it leads to periodontal changes and the loss of support, which in turn leads to tooth loss. The upper first premolar is sensitive to the effects of the traumatic forces most probably due to anatomic and morphological characteristics of the tooth itself. On the other hand, the presence of dysfunctions may predispose the loss of the first upper molar. Anyhow, tooth loss and teeth arch integrity disturbance may be considered as etiological factors in the development of TMD [18].

The analysis of dynamic and static components of occlusion failed to reveal significant differences between the patients with the signs and symptoms of dysfunctions and patients free of any signs and symptoms [11].

Studies carried out by Posselt [10] evidenced that out of 20 subjects with occlusal interferences relieved of complaints achieved by selective grinding led to cure in 50% of them, significant improvement was achieved in 20%, improvement in 0%, slight improvement in 15%, and no improvement in 5%. The above findings support the fact that occlusal factors may lead to TMD.

Studies carried out by other authors evidenced absence of significant correlation between occlusal interferences and the signs and symptoms of TMD [11, 14, 20].

OBJECTIVE

The aim of this study was to estimate the role of occlusal factor in the aetiology of craniomandibular dysfunction and therapeutic effects of the irreversible occlusal therapy (occlusal equilibration) in patients with TMD.

METHODS

The study included 200 males and females, aged ranging between 18 and 35 years, with preserved natural occlusion. All the subjects underwent detailed clinical examinations and a detailed functional analysis of the occlusion aimed at evidencing the presence of positive signs and symptoms of TMD. The results of clinical examination and functional analysis were objectively validated using craniomandibular index (CMI) according to Friction and Schiffman [21].

Based on the values of the index, a study group composed of 15 subjects with natural occlusion in whom certain signs and symptoms of TMD were observed was formed. The patients underwent occlusal equilibration (selective grinding) according to Okeson [22] using the centric position as the reference position in the course of occlusal therapy. Thirty days after occlusal equilibration, dysfunction index according to Friction and Schiffman was repeatedly validated (CMI II).

RESULTS

Occlusal interferences

It was evidenced that 88.7% of the subjects had occlusal interferences in the ICP and upon contact movements of the mandible. In 66.3% of the subjects, the interferences were localized to the mediotrusive side, and in 40% of the subjects they were localized to the posterior teeth in propulsion, while in 26.7% of the subjects they were localized in the ICP.

Occlusal disorders with mandibular laterotrusion movements

Mandibular movement into the left lateral position, contacts on the mediotrusive side on the first and second molars were evidenced in 66.3% of the subjects. The contacts were localized to the linguomesial cusps of the upper molars and buccodistal cusps of the lower molars.

The majority of the contacts on the mediotrusive side were localized upon the mandibular guidance to the left side on the buccal inclinations of the linguomesial cusps of the second upper molars and lingual inclinations of the buccodistal cusps of the lower, second molars (Graph 1).

Molar contacts on the mediotrusive side were evidenced in 19.8% of the study group subjects at mandibular movement into the right lateral position. The contacts were localized to linguomesial cusps of the upper molars and buccodistal cusps of the lower molars.

The majority of the contacts on the mediotrusive side were localized at the mandibular guidance to the right side on the buccal inclinations of the linguomesial cusps of the upper molars and lingual inclinations of the buccodistal cusps of the lower molars (Graph 2).

Occlusal disorders with protrusion

Lateral teeth contacts were evidenced with mandibular movement in propulsion in 40% of the subjects. Localization of the occlusal contacts (interferences) is presented on Graph 3. Occlusal interferences were evidenced on the first premolars in one subject from the study group, on the second premolars in three subjects and on the first and second premolars in three subjects.

CMI validation before and after occlusal equilibration

The functional analysis of the orofacial system condition in the study group subjects and CMI validation according to Fricton and Schiffman before and after occlusal equilibration by selective grinding provided the information on the role of this type of therapy in subjects with TMD. The CMI I was calculated in all subjects of control and study groups. The CMI II was calculated in the experimental

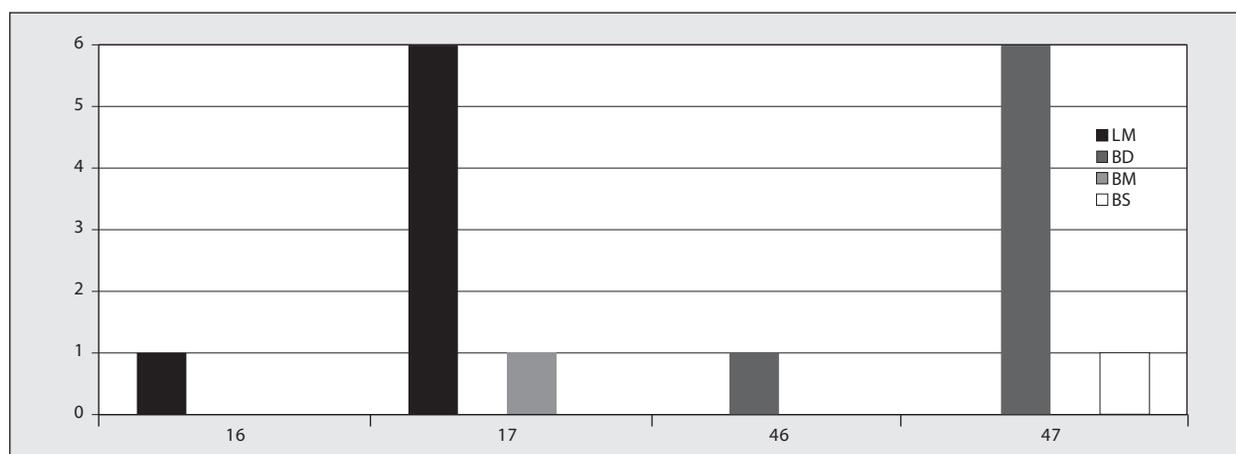
group subjects who underwent occlusal equilibration by selective grinding. Ten subject from the study group gave their consents for selective grinding, and thus the CMI II calculated for these subjects was compared with the previous CMI I obtained in the same subjects (Wilcoxon's parametric test of dependent samples) (Table 1).

The application of variances (Wilcoxon's test) evidenced statistically significant difference between the CMI values calculated before and after treatment (Table 2).

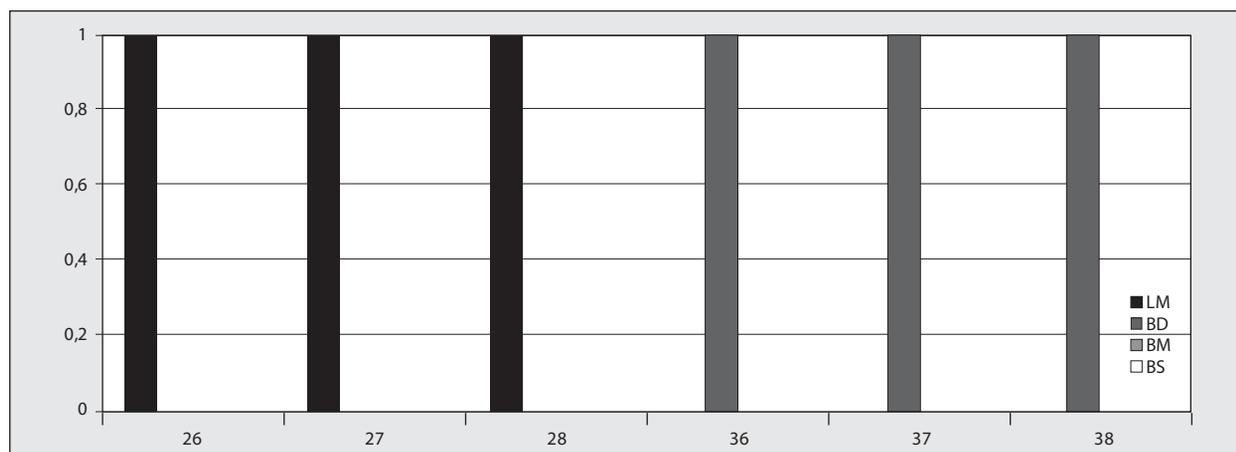
The objective of the therapy with occlusal equilibration using selective grinding was well accomplished, since the obtained results were grouped around the mean CMI I value and standard deviation was reduced. Graph 4 reveals the reduced mean value of CMI II in comparison to the CMI I by 0.18.

DISCUSSION

The study confirmed the presence of occlusal disorders on the mediotrusive side in 66.3% of the study group subjects, which is consistent with other findings [10, 11, 12]. However, the results of investigations have shown that the disorders affecting the mediotrusive side are different in comparison to the results obtained in this study, which is most probably the result of different investigational methods, as well as different samples used in the studies [13, 14, 20].



Graph 1. Localisation of occlusal contacts in the mediotrusive side in the study group

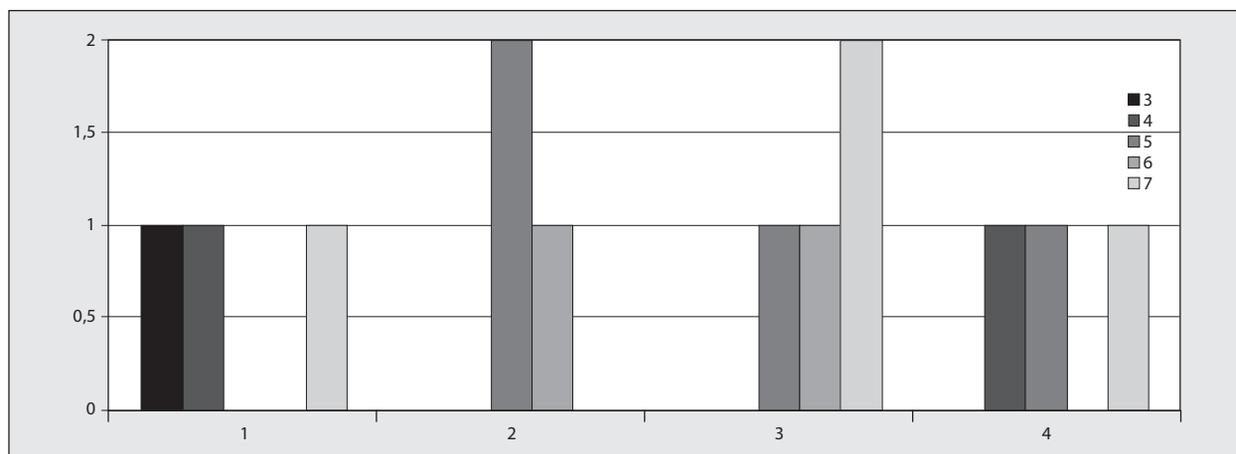


Graph 2. Localisation of occlusal contacts in the mediotrusive side in the study group

However, it is true that significant presence of the occlusal disorders on the mediotrusive in the study group may be correlated with the evident signs and symptoms of dysfunctions in subjects from this group, particularly with the signs of muscle hyperactivity, painful tenderness of the certain groups of the orofacial muscles and restricted movements of the lower jaw. Since at the same time, the signs of TMD in the study group are mostly associated with milder phases of the possible diseases of temporomandibular joints, the assumption that occlusal interferences represent the triggering factor in the development of diseases seems to be logical. The former also applies to occlusal interferences (lateral teeth contacts) with mandibular propulsion, which we found in 40% of the experimental group subjects.

The above was further confirmed by the fact that occlusal equilibration by selective grinding, i.e., removal of the prema-

ture contacts in the RCP and ICP on the mediotrusive side and upon protrusion led to significant reduction of the signs and symptoms of TMD in the study group. The former is evidenced by CMI index values after occlusal equilibration. Accordingly, occlusal equilibration may be recommended as a successful form of occlusal therapy in individuals with TMD and evident occlusal discrepancies. The investigations carried out within the ongoing study evidenced that subjects with the signs and symptoms of TMD had a significantly smaller number of occlusal contacts in the ICP, which was indicative of less stable occlusion in this group of subjects. However, it is true that the average number of contacts in the ICP is highly different in individuals with physiological occlusion, regardless of the presence of signs and symptoms of TMD. The former is confirmed by the results of numerous studies in which contacts in the ICP were investigated [5, 8, 22, 23, 24].



Graph 3. Localisation of occlusal interferences on the posterior teeth at protrusion in the study group

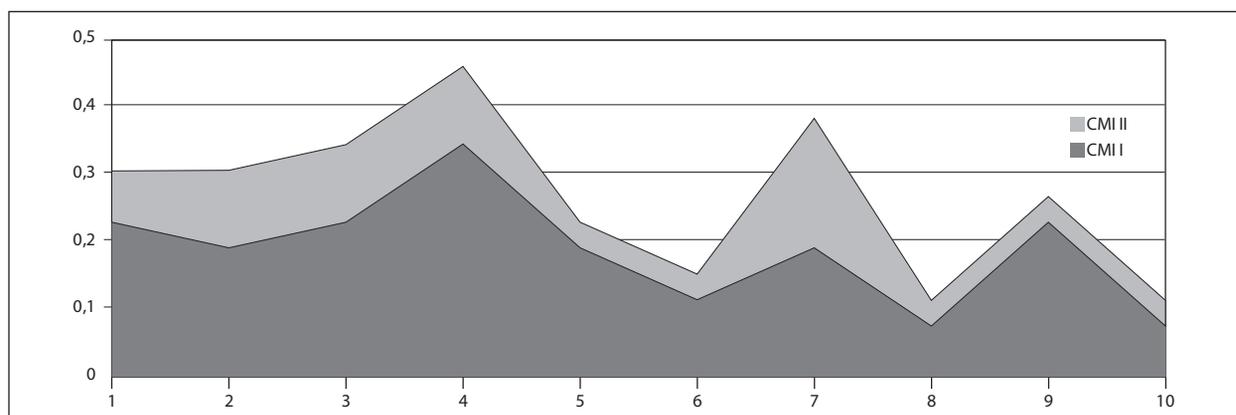
Table 1. The value of craniomandibular index (CMI) according to Fricton and Schiffman before (CMI I) and after occlusal equilibration (CMI II)

Index	Patient									
	1	2	3	4	5	6	7	8	9	10
CMI I	0.23	0.192	0.23	0.346	0.192	0.115	0.192	0.076	0.23	0.076
CMI II	0.076	0.115	0.115	0.115	0.038	0.038	0.192	0.038	0.038	0.038

Table 2. The value of craniomandibular index (CMI) before and after occlusal therapy

Index	Number of patients	\bar{X}	Min.	Max.	SD	Z*	p*
CMI I	10	0.188	0.076	0.346	0.082	-2.673	<0.008
CMI II		0.08	0.038	0.192	0.053		

* Wilcoxon test



Graph 4. Values of craniomandibular index (CMI) I and II

The results of the studies are, however, hard to compare due to different objectives of the studies, their methods and types of analyses. Therefore, it is difficult to bring conclusion on the optimal or minimal number of occlusal contacts in the ICP required for the maintenance of the proper functioning of the orofacial system. Therefore, it is impossible to establish a direct correlation between the number of ICP and TMD aetiology, having in mind large individual differences between the subjects with natural occlusion and exceptional adaptation capacities of the orofacial system.

CONCLUSION

The presence of premature contacts in the ICP, occlusal interferences on the mediotrusive side, as well as the presence of contacts between lateral teeth with mandibular protrusion

is significantly more common in the subjects included in the study group. The fact that mediotrusive side interferences evidenced in 76 % of the subjects included in the study group were not evidenced in the control group led us to conclude that occlusal interferences on the mediotrusive side may be associated with the presence of the signs and symptoms of TMD.

The significant reduction of CMI after occlusal equilibration (by 0.18) and the reduction of TMD symptoms in the study group also support the presumption that premature contacts in the ICP, occlusal interferences on the mediotrusive side, as well as later teeth contacts with mandibular protrusion may be perpetuating factors in the onset of TMD.

It has been also confirmed that occlusal equilibration with selective grinding represents an effective form of occlusal therapy in patients with TMD.

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Улога оклузије у настанку темпоромандибуларних дисфункција

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КРАТАК САДРЖАЈ

Увод Улога оклузивних дисхармонија у настанку темпоромандибуларних дисфункција (ТМД) и даље је питање у стручној литератури и клиничкој пракси које остаје без одговора. До осамдесетих година двадесетог века оклузивни фактори, као што су одређене малоклузије, разлике између ретродованог контактеног положаја и интеркуспалног положаја веће од 2 mm, оклузивне сметње (посебно медиотрузијске и ретрузијске) и губитак бочних зуба, сматрали су се главним етиолошким факторима у настанку ТМД.

Циљ рада Циљ рада је био да се утврди улога оклузивних фактора у развоју ТМД и оцени успех примене иреверзибилне оклузивне терапије (селективно брушење) код особа са ТМД.

Методe рада У сврху истраживања прегледано је 200 особа оба пола узраста 18-25 година. Знаци и симптоми ТМД су вредновани на основу посебне функционалне анализе и изражени краниомандибуларним индексом (CMI) по Фриктону (*Friction*) и Шифману (*Schiffman*). На основу овога индекса формирана

је студијска група коју је чинило 15 испитаника са знацима и симптомима ТМД. Код њих је урађено селективно уклањање оклузивних сметњи брушењем према методи Оксона (*Okeson*) коришћењем централног положаја као референтног положаја током оклузивне терапије. Вредновање CMI је поновљено тридесет дана након оклузивног уравнотежења.

Резултати Резултати истраживања су показали значајно смањење знакова и симптома ТМД после оклузивног уравнотежења. Статистичком анализом је утврђено да између вредности CMI пре лечења (CMI I) и тридесет дана каније (CMI II) постоји статистички значајна разлика. Вредност CMI I била је између 0,076 и 0,0346, док је средња вредност била $0,188 \pm 0,082$. Вредност CMI II била је између 0,038 и 0,19, а средња вредност $0,038 \pm 0,053$.

Закључак Ова студија је потврдила значај иреверзибилне оклузивне терапије (селективно брушење) код особа са ТМД.

Кључне речи: темпоромандибуларне дисфункције; оклузивне сметње; оклузивно уравнотежење