The role of occlusion and occlusal adjustment on temporomandibular dysfunction

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Abstract
There is a great controversy related to the role of occlusion and its usage on occlusal adjustment as a treatment of temporomandibular disorders. Occlusal adjustment is a clinical procedure in which modifications are done on teeth surfaces, restorations or prostheses, through selective wear or restorative materials addition, seeking to harmonize maxillo-mandibular functional aspects in centric occlusion and eccentric movements. The adjustment aims to obtain appropriate jaw stability free from premature contacts and occlusal interferences. The aim of this paper is to elucidate the role of occlusion and occlusal adjustment in Temporomandibular Dysfunction and to guide the professional when indicating it.

Key Words:
dental occlusion, occlusal adjustment, temporomandibular joint dysfunction syndrome.

Introduction

A great number of professionals associate the term Temporomandibular Dysfunction (TMD) solely to Temporomandibular Joint (TMJ) Disorders. According to Ramfjord and Ash[1], TMD is related to any disharmony affecting the teeth and support structures functional relations, the masticatory muscles, the maxilla and mandible, the TMJ, and all neurovascular supply of these structures. Kirveskari[2], stated that TMD is considered to be a heterogeneous cluster of conditions affecting the masticatory muscles and/or the TMJ.

The etiology of TMD has been considered to be multifactorial[3-5], but generally caused by an untoward interplay between neuromuscular, TMJ, occlusal and psychological factors[4]. In relation to the psychological factor, Yap[6] stated that patients diagnosed with myofascial pain and other joint conditions (arthralgia, osteoarthritis) had significantly higher levels of depression and somatization than patients diagnosed with only disk displacement. According to McNeill[3], the etiologic factors of TMD include: genetic, physiologic, traumatic, pathologic, environmental, and behavioral factors.

TMD is characterized by tenderness in the masticatory, head and neck muscles; painful TMJs; limited mandibular movements; joint noises, and facial deformities. Headaches, earaches, neckaches and toothaches are frequently listed as patient's complaints. Kirveskari[2] related that the most common subjective symptoms include facial pain, headaches, TMJ sounds, and problems associated with jaw movements. The consequences of these problems include damages on teeth, periodontal tissue, TMJs and neuromuscular system as well as functional disturbances during chewing, swallowing, and speaking.

There is a great controversy related to the role of occlusion in the etiology of TMD[7]. Thus, it is important to discuss this issue before to question the relationship between occlusal adjustment and TMD. According to Kirveskari[8], controlled clinical studies results are difficult to understand unless occlusion is taken as an etiologic factor of TMD. Besides, a lot of studies have failed on proving that occlusion has nothing to do with TMD. Jarabak[9] affirms that occlusal instability with loss of posterior support might cause some subclassifications of TMD including muscle spasm. There are a lot of studies proving the association between occlusal factors to signs and symptoms of TMD[2,10-12]. Kirveskari[13] examined the association between occlusal interferences and signs of TMD over a period of 6 years in two cohorts of children, half of whom underwent occlusal adjustment annually. The annual examination included observations of muscles and joint palpatory tenderness, joint sounds, and measurements of mandibular mobility. The last examination in the sequence was occlusal analysis including measurements of retrusive-intercuspal position (RP-IP) distance, observations of first contact on hinge closure, of the presence of mediotrusion contacts, and of postcanine laterotrusion and protrusion contacts. The authors concluded that occlusal adjustment resulting in a modest decrease in the number of occlusal interferences was sufficient to disclose a significant association between the number of occlusal interferences and clinical signs of TMD in two nonpatient child populations. In another study Kahn[14] evaluated the prevalence of molar relationship, lateral guidance and nonworking side contacts and intraarticular temporomandibular disorders. They showed a higher prevalence of Class II, Division 1 relationships on the left side compared with the asymptomatic volunteers with normal joints. Pullinger[15], however, showed high frequency of TMJ tenderness on class II, Division 2 patients. In the same study they noted that clicking with movement of the condyle over the articular eminence on wide jam opening was significantly associated with unilateral posterior crossbite. In relation to RP-IP relationships a high frequency of TMJ sounds occurred in subjects with asymmetric slides of 1 mm or more, although Beyron[16] stated the necessity of freedom in mandible movement of 0,5-1,0 mm between RP-IP. According to Long[11] tenderness in masticatory muscles, confirmed by palpation, is insufficient to imply an occlusal etiology, but, when the inferior belly of the lateral pterygoid muscle is more tender to palpation than the other muscles of mastication and a stress test is positive an etiologyc occlusal role must be suspected. Seligman[17] showed that occlusal factors have only a selective influence on muscle pain and some association between generalized muscle tenderness and deep vertical overlap is real; nevertheless, they did not find an association between crossbite or RP-IP slides and muscle tenderness. The authors concluded that although occlusal factors are not good predictors of muscle tenderness, intracapsular signs of TMJ disorders and muscle tenderness are often associated. Kirveskari[10] in a cross-sectional analysis after a 3-year study, showed a clear association between the number of interferences and the signs of TMD. Al-Hadi[18] evaluated the possible relationaship between TMD and a number of occlusal parameters (Angle's Classification, type of eccentric occlusion, chewing side preference, horizontal overlap value and non-working side contact structures). His results showed high dependence between the frequency of TMD and class II Division 1, class III patients, group function occlusion, and a high horizontal overlap value. When non-working side contacts increases a higher association of TMD is observed. Within the results of this study the author concluded that TMD: is prevalent on the chewing side; is associated with an increased incidence of non-working side contacts and with high horizontal overlap; in canine protected occlusion its incidence is low. In relation to the type of occlusal guidance, Manns[19] in an electromyographic (EMG) study concluded

that canine guidance, compared with group function, causes a greater EMG activity reduction of the elevator muscles, and this reduction in activity suggests that the stomatognathic system is more effectively protected against unphysiologic muscle tension.

Pertes and Bailey[20] stated that, in the past, occlusal factors as RP-IP slides or the presence of non-working side contacts were considered to be primary etiologic factors of TMD; however, according to the same authors, neither clinical nor reviewing studies have been capable to stablish a correct correlation between occlusal factors and TMD symptoms. This shows that many individuals may adapt to occlusal discrepancies within tolerable limits without displaying signs or symptoms of TMD. Occlusion may be of secondary importance and exacerbates symptoms after the onset of TMD from other causes[20]. Pullinger and Seligman[21] affirm that occlusal factors may be considered co-factors when diagnosing patients with TMD, but its value should not be super-estimated. Rather than a causal role, an occlusal discrepancy seems to be TMD consequency.

Similar to the role of occlusion as an etiologic factor of TMD the use of occlusal adjustment as a treament for TMD has been extensivelly questioned[8]. Thus, it is important to state the definition of occlusal adjustment. Many professionals associate the term "occlusal adjustment" as a procedure of reshaping sound tooth structure. However, the occlusal adjustment is a terapheutic procedure of modifications on teeth surface, restorations or prosthesis accomplished by a selective tooth reshaping or the addition of restorative materials in an attempt to get a harmonic occlusal relationship in centric relation and during eccentric jaw movements. Bulter[22] defines occlusal adjustment as a modification on the occlusal tooth surfaces in order to get an harmonic relationship between these surfaces. The occlusal adjustment is an invasive and irreversible procedure which may contribute to the stablishment of a stable occlusion and a comfort function of the masticatory system[23]. The occlusal adjustment therapy is frequently used on the following situations: before and after a restorative procedure, after orthodontic therapy, after periodontal therapy, in a attempt to get stable occlusal contacts during bruxism or clenching episodes, during the correction of primary or secondary trauma and during the TMD treatment[24]. Bailey[25] defined the indications for occlusal adjustment as: the removal of occlusal interferences or prematurities before a cavity preparation; the presence of oclusal overload contacts or forces not directed to the tooth long axis; on long term TMJ dysfunction cases (this will not always be the first election therapy, but if any restorative treatment are to be employed it is recommended); to achieve occlusal stability after orthodontic therapy or in bruxism patients. According to Kirveskari[8] the efficacy of this irreversible treatment modality has been questioned because of the lack of evidence that occlusal factors play an etiologic role, the self-limiting character of the disorders, the possibility of adverse effects and the fact that other reversible modalities are avaible. However, several long-term studies have disclosed no adverse effects of occlusal adjustment apart from a transient tooth sensivity in a very small number of cases[8].

Several studies have analised the role of occlusal adjustment in TMD treatment. Forssel[26] evaluated headache patients with signs and symptoms of mandibular dysfunction who were ramdomly assigned to a treatment or placebo group. In the treatment group all patients received occlusal adjustment, which was aided by the use of full occlusal splints in 19 cases. In the placebo group 43 patients received mock occlusal treatment. The symptom changes were assessed by means of a double-bind design after the period of 8 months on the treatment group and 4 months on the placebo group. Both groups showed a decrease on mandibular dysfunction symptoms, but the decrease of signs was statistically greater on the treatment group. This fact seemed to be related to the use of full occlusal splints. Vallon[27] evaluated the therapeutic effect of occlusal adjustment on symptoms and signs of TMD, including headache, after 3 and 6 months, showing that this treatment modality has a significant short-term effect on symptoms of TMD of muscular origin. Zieberg and Donegan[28] analyzed the possible relationship between the number and type of occlusal contacts before, right after, and after 6 weeks of the occlusal adjustment had been performed. They related that 6 out of 10 patients had no sings of RP-IP slides after 6 months, and the number and type of occlusal contacts remained the same right after of after the period of 6 months. The remaining 4 patients which had recovered the TMD symptoms had also lost one tooth. This result showed that dental arcs with missing teeth do not remain stable after occlusal adjustment. Wenneberg[29] studied two groups of TMD patients. One group received just occlusal adjusment and the other the association between occlusal adjustment and occlusal splints. The results were obtained by means of a questionnaire, visual analog scale and clinical examination procedures. Both groups related a decrease on symptoms, but the association of modalities was more effective than the occlusal adjustment performed alone, especially when analyzing the clinical signs of TMD. Magnusson and Carlsson[30] evaluated 34 patients under TMD treatment, after 2.5 years. 11 patients were recommended to receive occlusal adjustment but just 9 assigned to the treatment. After 6 weeks, 7 out of 9 patients showed a decrease in signs and symptoms of TMD. Clark[31] does not recommend the use of occlusal adjustment in young adults or children as a way to prevent TMD. Chasens[32] stated that occlusal adjustment should not be used unless primary or secondary occlusal trauma had been identified. Prophylactic occlusal adjustment is not justified[33]. According to Ogle[34], deflective occlusal contacts

may create complex neuromuscular reflex activity and joint symptoms which may be relieved by adjustment of the occlusion.

Discussion

There are great controversies on the role of occlusion as an etiologic factor of TMD, and on the role of occlusal adjustment on its treatment. The TMD treatment is hard to be accomplished because of its multifaceted characteristics. Thus, the comprehension of occlusion as an etiologic factor of TMD affects the choice of treatment modalities even when efficacious symptomatic treatment methods are avaible[8]. Several authors associate the signs and symptoms of TMD with occlusion[8-10,13,17-18,27]. Other researchers state that occlusion is partially associated to TMD[14-15,17] On the other hand some authors suggest that occlusion has a secondary role on the etiology of TMD[20-21].

Kireskary[13] studied the association between occlusal interferences and signs of TMD over a period of 6 years in two cohorts of children, half of whom underwent occlusal adjustment annualy. They concluded that occlusal adjustment resulted in a modest decrease in the number of occlusal interferences, sufficient to disclose a signiciant association between the number of occlusal interferences and clinical sings of TMD in the two nonpatient child populations.

Al-Hadi[18] showed a high dependence between the frequency of TMD and class II division 1, class III patients, group function occlusion, and a high horizontal overlap value. He also states that TMD: are prevalent on the chewing sides, are associated with an increase incidence of nonworking-side contacts and with the presence of high horizontal overlap, and in canine protected occlusion their occurence is low. When any type of occlusal interference is created after a rehabilitantion procedure the patient tends to chew on the same side of the interference in order to avoid the incidence of nonworking-side contacts, which could be harmfull for them. This fact can be confirmed by Al-Hadi[18] who proved that TMD is more prevalent on chewing sides, and as nonworking side contacts increase the incidece of TMD also increases. In relation to the type of occlusion, Manns[19] suggested that the stomatognathic system is more effectivelly protected against unphysiologic muscle tension in canine guidance than in group function occlusion. This study confirms the fidings of Al-Hadi[18] who observed low incidence of TMD in canine guided occlusion.

In relation to the association between intraarticular TMD's and Angle's classification the opinions are controversial. Pullinger[15] noted a high frequency of TMJ tenderness on class II division 2 patients. Kahn[14] evaluated the prevalence of molar relationship, lateral guidance, and nonworking side contacts and intraarticular TMD's, concluding that symptomatic patients had a higher prevalence of class II division 1 compared with the asymptomatic volunteers with normal joints. Nevertheless, Al-Hadi[18] showed a high association of TMD and class II division1 or class III patients. In the same study he showed that class II division 2 patients had lower incidence of TMD when compared to the other Angle's classifications. As it can be seen, Angle's malocclusions have been shown to have an association with intraarticular TMD's somehow.

Beyron[16] stated the necessity of freedom for the mandible between RP-IP of about 0.5-1.0mm. However, Pullinger[15] related higher frequency of articular tenderness in the presence of RP-IP slides of 1.0mm or more, although the results had no statistical significance due to the limited sample size. Seligman[17] however, showed no association of RP-IP slides and muscle tenderness, concluding that occlusal factors have only a selective influence on muscle pain and TMD, but there seems to be an association between TMD and occlusal factors.

Al-Hadi[18] evaluating nonworking side contacts, reported that as these contatcts increase a higher association with TMD is developed. Kahn[14] stated that some patients developed signs and symptoms of TMD even when nonworking side contacts were absent. Thus it is implicit that these signs and symptoms were also developed when these contacts were present. This fact may confirm once more the association between nonworking side interference contacts and TMD.

In relation to overlap relationships Al-Hadi[18] noted that high horizontal overlap is associated with an increased TMD occurrence. Nevertheless, Seligman[17] showed some association between generalized muscle tenderness and deep vertical overlap, confirming the assumption that there really is an interrelation between this factor and TMD.

Considering the association between occlusal factors and muscular tenderness, Kirveskary[8] stated that muscular pain seems to be related to the presence of an occlusal risk. Long[11] noted that when a lateral pterygoid muscle is more tender to palpation than the other muscles of mastication, and a stress test is positive, an occlusal cause should be suspected. Seligman[17] showed a selective influence of occlusal factors and muscular pain. Pertes and Bailey[20] stated that many individuals are capable to adapt to occlusal discrepancies within tolerable limits, without the presence of signs and/or symptoms or TMD. However, it is not possible to predict either the adaptive capacity or the tolerance limits of each patient.

In spite of the fact that the role of occlusion has been questioned as an etiologic factor of TMD, the use of occlusal adjustment as a treatment modality for TMD is also controversy.

According to Ogle[34] deflective occlusal contacts may create complex neuromuscular reflex activity and joint symptoms. Thus, the removal of these interferences would relax the musculature relieving the symptoms. This is in agreement

with the assumption that the proprioceptive memory of premature contacts is lost after occlusal adjustment[11] permitting a reduction of muscular tenderness because when the muscles are relaxed the blood flow is again adequate to minimize ischemic pain. Vallon[27] showed that occlusal adjustment is a treatment modality with a statistically significant short-term effect on symptoms of TMD of muscular origin.

Several studies relate the use of occlusal adjustment on the treatment of TMD[13,24,27,35]. Bailey[25] recommends occlusal adjustment to long-term treatment of TMD; however, he states that this is not the first election therapy. Forssel[35] showed a clear reduction in the frequency of headache after the accomplishment of occlusal adjustment. Vallon[27] as previously described, showed a statistically significant short-term effect of occlusal adjustment on symptoms of TMD of muscular origin. Forssel[26] concluded that both placebo and treatment group had a reduction on symptoms of TMD, but a higher reduction on TMD signs was seen on treatment group (occlusal adjustment). Magnusson[30] after the accomplishment of occlusal adjustment in 9 TMD patients noted a reduction of signs and symptoms in 7 patients. The authors concluded that occlusal adjustment may have a good benefit to the treatment of signs and symptoms of TMD. However, Wenneberg[29] compared a combined treatment that included full occlusal splints and occlusal adjustment performed by itself. Both groups showed a reduction on symptoms, but the combined treatment regimen was more effective than occlusal adjustment alone on the reduction of clinical signs of TMD. This is easy to imagine because when a bunch of treatment modalities are put together to solve a clinical problem there is a greater chance to solve it.

According to Chasens[32] occlusal adjustment should only be performed if primary or secondary occlusal trauma is present. However, Christensen[5] affirms that just after a period of observation and reduction of the muscle pain, an occlusal equilibration must be accomplished to make the teeth come together in a harmonious intercuspal position. Zieberg and Donegan[28] analyzing the possible relationship between the number and type of occlusal contacts before, right after, and after 6 weeks of the occlusal adjustment had been performed, noted that dental arcs with missing teeth do not remain stable after occlusal adjustment. According to Long[11] before occlusal treatment, the dentist should evaluate the integrity of the articular elements and their relationship to each other during function and at rest, and the degree of occlusal modification necessary to achieve a simultaneous contact of the maxillary and mandibular teeth while the articular element are in apposition. As it could be noted there is no place for prophylactic treatment of the occlusion. Instead, occlusal adjustment should be accomplished after a meticulous patient evaluation identifying the existence of risk factors of TMD.

Temporomandibular dysfunction has been considered to have a multifactorial etiology, which seems to be related to: genetic, physiologic, traumatic, pathologic, environmental, and behavioral factors. Nonworking side contacts, slides between RP-IP, increased vertical or horizontal overlap and lost of occlusal stability due to missing posterior teeth are all occlusal factors related to signs and symptoms of TMD. Although some authors state that many individuals are capable to adapt to occlusal discrepancies within tolerable limits, without the presence of signs and/or symptoms or TMD, the clinical practice shows that it is not possible to predict whether the patient will adapt or not, and to establish the tolerance limits of each patient. Thus, the professional should always try to establish an harmonic occlusal relationship, avoiding the presence of prematurities and/or interferences that might possible cause any type of dysfunction. In the presence of muscular tenderness an occlusal cause should be suspected. Occlusal adjustment must be employed only when an occlusal disarrangement is noted because it should be considered preventive treatment and not a prophylactic one. Since TMD etiology is multifactorial a multidisciplinary treatment must be considered in other to better treat the patients, gathering the following areas: Dentistry, Physiotherapy, Psychology, and Medicine.

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