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Review Article

Temporomandibular disorders and occlusion effect on orthodontic treatment

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ABSTRACT

Evidence in the literature indicates the significant association between temporomandibular joint disorders and orthodontic treatment. As a result of the epidemiological investigations that indicated the high prevalence of temporomandibular disorders among patients with malocclusions, it has been suggested that there might be a cause-and-effect correlation between both of these conditions. Evidence in the literature is inconsistent regarding the association between temporomandibular joint disorders and malocclusion, and orthodontic treatment. In the present literature review, we have discussed the different aspects of temporomandibular disorders and malocclusion and their relation to orthodontic treatment approaches. Among the different studies in the literature, solid evidence indicates a significant association between temporomandibular joint disorders and malocclusion, and accordingly, research aimed to study the impact of orthodontic treatment on curing and preventing the development of these disorders. The current evidence seems to be neutral regarding the impact of orthodontic treatment approaches on curing and preventing temporomandibular disorders. Therefore, it has been suggested that further investigations are still needed for adequate further evaluation. Finally, as we previously discussed, the attending orthodontist should adequately take care of certain parameters in these patients, including centric relation, maximal intercuspal position, simultaneous contact points, and evaluating the direction of forces applied on the relevant teeth.

Keywords: Orthodontics, Malocclusion, Temporomandibular, Management, Orofacial

INTRODUCTION

Evidence in the literature indicates the significant association between temporomandibular joint disorders and orthodontic treatment. As a result of the epidemiological investigations that indicated the high prevalence of temporomandibular disorders among patients with malocclusions, it has been suggested that

there might be a cause-and-effect correlation between both of these conditions.[1-4] This has been indicated by the anatomical fact that teeth occlusion and temporomandibular joints are significantly correlated. Accordingly, it has been demonstrated that applying orthodontic treatment modalities can effectively relieve the temporomandibular joint disorders that are related to the malocclusion defects.

Different symptoms and signs have been associated with temporomandibular joint disorders, and therefore, clinicians aimed to continuously update and modify the diagnostic and management approaches to enhance the outcomes for the affected patients. Many symptoms and signs were reported in the literature, including limited mouth opening, altered mandibular movement, constrain function, associated joint pain with the mandibular movements, associated radiographic changes in asymptomatic cases during mouth opening and closing and joint noises.[5] Evidence in the literature is inconsistent regarding the association between temporomandibular joint disorders and malocclusion and orthodontic treatment. The aim of the study was to conduct the current literature review to adequately discuss temporomandibular disorders and the occlusion effect on orthodontic treatment.

METHODS

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 15th September 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing poetential studies, a further manual search for papers was done through Google Scholar while the reference lists of the initially included papers. Papers discussing temporomandibular disorders and the occlusion effect on orthodontic treatment were screened for useful information. No limitations were posed on date, language, age of participants, or publication type.

DISCUSSION

Many considerations should be given during conducting orthodontic treatment for patients suffering from occlusion and temporomandibular joint disorders. For instance, previous investigations have indicated the importance of centric position and its relation to conducting adequate orthodontic treatment approaches with favorable outcomes. Centric relation (CR) is considered by orthodontists to adequately decide and designate whether the condyles of the jaw are properly positioned in their right fossae or not. The Maximal intercuspal position (MI) is a term used to describe the position of the jaw in relation to the potentially present occlusion, and both of these terms should be adequately cared for during the orthodontic treatment plan by the attending orthodontist. Studies indicate that both the MI and CR rarely coincide with each other in most cases, and estimates show that a 1.75 mm deviation is usually noticed between the two parameters in up to 90% of the general population.[6-9] Other parameters were also reported in the literature to consider when planning an orthodontic treatment approach. These include the vertical dimension, which should be maintained at a favorable point, in addition to establishing the lateral and immediate anterior guidance protocols before deciding and establishing the most appropriate treatment plan. Simultaneous contact points should also be obtained, and adequately evaluating the direction of forces applied on the relevant teeth is also recommended to conduct successful orthodontic treatment modalities.[10-14]

Different studies have demonstrated a significant association between occlusion and temporomandibular disorders. Accordingly, following these proposed associations between the occlusal factors, malposition of the jaw, and temporomandibular disorders, it has been reported that the orthodontic treatment might also be involved in this correlation and might also affect the expected outcomes. Evidence indicates that orthodontic treatment can significantly relieve and prevent the development of temporomandibular disorders that have been associated with the occlusal effects. The orthodontic treatment in these situations aims at achieving harmony between the occlusal pattern and the physiological relations of the mandible. Another approach would be to re-modulate the position of the mandibular condyles to their normal regions within the glenoid fossae. In another context, it has been furtherly demonstrated by previous investigations that some approaches of the orthodontic management modalities might be associated with a significant impact on the development and triggering the initiation and maintenance of the different clinical manifestations.[15]

Another more recent investigation, on the other hand, also indicated that the impact of orthodontic treatment seems to not significantly impact the outcomes related to the temporomandibular joint disorders, whether negatively or positively.[16] In this context, previous investigations have indicated that conducting orthodontic treatment did not significantly impact the risk of developing temporomandibular joint disorders in patients suffering from class II and III skeletal malocclusions, whether by decreasing or increasing the estimated risk.[17-19] Besides, in cases of retracted maxillary teeth, it has been demonstrated that conducting premolar extractions modality was associated with manifestations of a posterior repositioning of the condyles as assessed using cone-beam computed tomography imaging modalities.[20]

However, evidence regarding the impact of the approach on the induction of disc displacement is still poorly reported, and further investigations are required to comprehend this association furtherly. During fixed orthodontic treatment, using intermaxillary elastics was investigated in a previous study that reported that increased stress over the temporomandibular joints was

associated with the application of these modalities, particularly among patients suffering from class II malocclusions.[21] However, it is also still not adequately clear whether the modality can significantly impact the development of true manifestations related to the temporomandibular joint or not. Recent evidence shows that adult patients also prefer to use clear aligners with the orthodontic treatment due to the favorable aesthetics in relation to their daily activities.[22]

In patients suffering from sleep bruxism, evidence indicates that thermoplastic customized devices for orthodontic treatment are favorable in these events based on their abilities to achieve full occlusal coverage rates, which furtherly allows such approaches to protect the dental surfaces from any potential dental wear.[23] On the other hand, another investigation reported that in patients with sleep bruxism, no apparent favorable events were obtained secondary to the application of invisible orthodontic retainers. It has been furtherly demonstrated by Manfredini and colleagues that the activities of the mastication muscles also significantly increased during sleep following the application of the orthodontic retainer devices.[24] However, it should also be noted that no significant differences were noticed regarding the development of relevant clinical manifestations between wearing or not these devices. In this context, other relevant investigations have also demonstrated that following six months of orthodontic treatment with clear aligners, a significant increase in the masticatory muscles electromyographic activities were noticed.[25,26]

Additionally, evidence indicates that patients have also reported an increase in muscle soreness by one month after orthodontic treatment following waking up. Furthermore, it has been demonstrated that an increase in the frequency of the severity of painful sites when palpating the orofacial muscles and temporomandibular joints were also reported among these patients. However, the same investigation that reported these adverse events also indicated that these manifestations are observed for a short period only and usually resolve to baseline in a short duration.[27] More recent investigations have also suggested that using active and passive aligners are also recommended to relieve the previously reported short-term adverse events of jaw soreness after waking up.[28,29] However, these studies also indicated that not a single subject that was included in this study suffered from a temporomandibular joint disorder. Therefore, it can be concluded that the current evidence indicates that the activities of the masticatory muscle activities are not reduced and are potentially increased when using clear aligners. However, the current evidence should be furtherly strengthened by additional relevant investigations to validate these outcomes adequately.

Accordingly, adequate considerations should be given to patients that are at increased risk of developing mastication-related pain due to applying invisible orthodontic devices. Evidence regarding applying these modalities among patients with bruxism is also insufficient to draw a solid conclusion. Therefore, further research is encouraged in this context as well. Based on the findings from the current investigations, conducting orthodontic treatment is not significantly associated with neither treating or inducing temporomandibular disorders.[30] Thus, conducting orthodontic treatment modalities aiming at developing an ideal occlusal status to adequately cure or prevent the formation of temporomandibular disorders is not adequately evidenced among the different studies in the literature.[31]

Based on the evidence of the current investigations, many authors have indicated that the approach of orthodontic treatment can significantly depend on the severity and intensity of malocclusion and the underlying temporomandibular disorders. However, it should be noted that identifying the disorders has been inconsistent among the various included studies and represented a significant issue for healthcare professionals to compare the different tools that can adequately assess temporomandibular disorders to plan the most appropriate treatment plan adequately. Although historical evidence indicates that the etiology of temporomandibular disorders is mainly attributable to a biochemical factor, recent investigations indicate that the etiology of these disorders is multifactorial, and such evidence shows that social, psychological, and social factors are involved.

Accordingly, the definition of occlusion can significantly point out the cause and effect association between temporomandibular disorders and occlusion effects.[30,32] Based on this proposed correlation, investigations indicate that following orthodontic therapeutic modalities, patients might be at increased risk of developing occlusions if they present with pain related to temporomandibular disorders and parafunctional habits, and being exposed more to developing maladaptive disorders. On the other hand, another investigation indicated that the occlusal tactile acuity did not significantly change in patients that did not suffer from temporomandibular disorders when myalgia was intentionally provoked.[33,34] This has been explained by the fact that psychological factors might be involved in patients with temporomandibular disorders that might attribute to the development of malocclusion. However, this pattern seems to be absent in free individuals when pain is intentionally provoked. Accordingly, it has been suggested that taking adequate precautions during dental treatment and examination should be considered by clinicians to enhance the outcomes and intervene against the potential development of maladaptive behaviors in the affected patients.[35]

Choosing the most appropriate orthodontic treatment plan has been inconsistent among the different studies in the literature. A previous investigation by Dibbets et al included 165 patients that suffered from different degrees of occlusion and were treated with different orthodontic treatment modalities, including the fixed and functional

devices.[36] By the end of the investigation, the authors concluded that the associated symptoms of the included patients were not consistent and had a sporadic pattern among them. There was no adequate evidence to establish an association between any of the used treatment modalities and developing manifestations that can be related to the temporomandibular joint disorders. In the same context, a previous cohort investigation by Sadowsky et al also reported the impact of premolars extraction using the orthodontic treatment on the potential development of manifestations related to the temporomandibular joint and found no increase in these events indicating no significant impact of orthodontic therapy on developing temporomandibular joint disorders.[37]

Previous comparative investigations that included patients with and without extraction treatment modalities also indicated that the rates of temporomandibular joint disorders were similar among the two included cohorts.[38,39] Another long-term cohort investigation also indicated the same findings, and therefore, it has been concluded that neither of the approached treatment modalities was associated with increased manifestations related to the temporomandibular joint.[40] A previous systematic review by Molhin et al that included 58 investigations, which were prospective and retrospective, also concluded that the current evidence does not support any potential association between malocclusion and developing temporomandibular joint disorders regardless of the approached treatment modalities on orthodontic treatment.[41] However, among the different studies, extensive calls for future investigations were observed because of the inadequate consistency of the current evidence.

Till future findings, the current evidence shows that the presence of occlusion does not impact the orthodontic treatment of the underlying temporomandibular joint disorders.

CONCLUSION

Among the different studies in the literature, solid evidence indicates a significant association between temporomandibular joint disorders and malocclusion, and accordingly, research aimed to study the impact of orthodontic treatment on curing and preventing the development of these disorders. The current evidence seems to be neutral regarding the impact of orthodontic treatment approaches on curing and preventing temporomandibular disorders, and therefore, it has been suggested that further investigations are still needed for adequate further evaluation. Finally, as we previously discussed, the attending orthodontist should adequately take care of certain parameters in these patients, including CR, MI, simultaneous contact points, and evaluating the direction of forces applied on the relevant teeth.

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