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Editorial

How do Occlusal Splints Work?

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There is a lot of information on the various types of occlusal splints available. However, there is a lack of information on how or why this splints would work in a patient with TMDS.

To understand, diagnose and treat the stomatognathic system which includes the TMJ components, masticatory muscles and dental occlusion [1], we need to understand the loading characteristics of the muscles of mastication and the effect of occlusion on stomatognathic system, which can be direct by changing the relations between the intracapsular TMJ element or indirect by affecting the muscles working conditions [2]. Even though no muscle acts alone, it is important to understand the dynamics and potential contribution of each muscle in generating functional and para functional loads which will further helps us understand why occlusal splints are important.

Occlusal splint therapy may be defined as "the art and science of establishing neuromuscular harmony in the masticatory system by creating a mechanical disadvantage for parafunctional forces with removable appliances" [3]. The mechanisms of action of the occlusal appliances as a treatment including occlusal disengagement, restoring vertical dimension of occlusion, muscles relaxing, joint unloading, or TMJ repositioning [4].

To understand how the splint therapy would help, we need to understand the basic nature of the muscles

Myofacial muscle pain is characterized primarily by pain and tenderness from the jaw-closing muscles [5]. The four important muscles are temporalis, masseter, medial and lateral pterygoid, of which all are elevators except the lateral pterygoid.

As an elevator, the insertion of temporalis muscle is very close to the TMJ, which acts as a fulcrum for elevation of the mandible. It's a muscle which is built for speed and not for power. Very little force is required to initiate and maintain fast mandibular elevation and posterior positioning. On the other hand, this same lever system is unable to resist heavy loads, particularly when they are applied to the anterior teeth, since this type of lever system has a very low mechanical advantage. Hence making it the most responsive of all masticatory muscles to anterior occlusion and occlusal interferences. Clinicians have learned to interpret a syndrome of parietal headaches, and bruxism with incisal prematurities and problems with anterior guidance [6].

When compared with the temporal muscle, the masseter muscle generates forces with a vector nearer the resisting load and farther from the TMJ fulcrum point. When the masseter muscle is fully active in concert with the medial pterygoid muscles and the temporal muscle, very high loads can be applied at the TMJ via the molar teeth during functional and parafunctional habits [6].

The medial pterygoid is positioner muscle and its contraction helps in elevation of the mandible. It becomes tender if the same side condyle must displace to achieve maximum intercuspation of the teeth [7]. When the medial pterygoid and masseter muscles are in spasm, or "splinted", the mandible exhibits restricted operating [6]. Such spasm is a common response to inflammation and pain within the TMJ [4].

Lateral pterygoid is also an important positioner muscle, which depresses the mandible and pulls the mandible forward every time the mandible leaves centric relation [7]. Lateral pterygoid muscle has the sole responsibility for forward positioning of the mandible to align with maximum interocclusal contact whenever centric relation is not coincident with maximal intercuspation. Centric relation is the only position that permits complete relaxation of lateral pterygoid muscle, hence it is completely inactive during maximum intercuspation and clenching in the retrusive position. Most important reason where the muscle gets involved is a forward movement that also requires a downward movement, thus the lateral pterygoid should hold the condyle down on the slippery condylar guidance while all the elevator muscles are pulling up [8].

Muscle pain due to occlusal interference is based on the theory where an interference is supposed to induce hyperactivity and spasm of the affected muscle, which in turn leads to ischaemia secondary to blood vessel compression. Ischaemic contractions are painful and activate muscle nociceptors [5].

Understanding the concept of occlusal splint therapy

Normal closing or relaxed position is at centric relation (CR), functional and parafunctional movements occur at intercuspal positions (ICP). Functional movements result in short and light contacts between maxillary and mandibular teeth, usually toward the end of the masticatory cycle [9], usually in this situation the number and area of tooth contact are less [10]. However, parafunctional activity may produce prolonged periods of heavy tooth contact with a doubling of the number of tooth contacts [9-12].

In 90% of the population maximum intercuspation occurs slightly forward from the centric relation [4,9]. However, contact between opposing teeth and the resultant proprioceptive response guides the mandible repeatedly into the habitual ICP, wherever it may be and the movements of the mandible and the joints play a more passive role, hence if there is any interference in occlusion, it lead to hyperactivity of the masticatory muscles. When the teeth are out of contact the movements of the mandible are guided by the articulating surfaces of the joints and not by the occlusal surfaces of the teeth, hence relaxing the masticatory muscles. This is the sole concept used in occlusal splint therapy [7,9].

Increase in number of tooth contacts influences the bite force, hence stable intercuspal contacts are required for proper distribution of forces, if a patient exhibit parafunctional activity, it is important to have stable ICP contacts from opposing posterior teeth so that the forces are distributed in the most favourable direction [13-15].

Unstable intercuspal contacts cause tilting and tipping of teeth especially in the absence of an intact arch, this leads to further loss of stable ICP contacts and increase the likelihood of interferences occurring between the posterior teeth during lateral and protrusive movements [9]. This interference during excursive movements in turn will hyper activate the closing muscles [16,17]. If stable contacts are present, the EMG of anterior temporalis and masseter muscle is decreased [13-15].

As explained earlier if there is an interferences in the arc of closure, the lateral pterygoid is rendered hyperactive [18], the disc is pulled anteromedially towards the origin of the muscle resulting in displacement, chronic and acute over loading of this kind of assembly leads to TMJ disorders [3,19]. Even a small (50micron) occlusal interference can initiate changes in coordinated muscle activity [20].

Patient needs to have an adequate anterior guidance, to reduce harmful lateral forces produced by parafunctional movements on interferences between posterior teeth. Contact between opposing teeth, preferably the canines in lateral excursion and the central incisors in protrusion, discludes the posterior teeth as soon as the mandible moves from ICP. This occlusal scheme most importantly reduces the number of tooth contacts occurring outside ICP. There is some evidence that this alters the proprioceptive feedback to the CNS which in turn reduce the level of activity in the masticatory muscle [21,22].

A splint with equal intensity of contact on all of the teeth with immediate disclusion of all posterior teeth by anterior guidance and condylar guidance in all the movements will relax the elevator and positioning muscles [16]. Studies have shown that the elongation of elevator muscles to or near the vertical dimension of least EMG activity by means of occlusal splint is effective in producing neuromuscular relaxation [23,24].

Conclusion

An occlusal splint can be used for pre-restorative management, muscle relaxation therapy and protecting both teeth, restoration and TMJ from excessive loads and further wear.

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