

# An Overview On The Effect Of Occlusal Splint Therapy On Muscle Function

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## **ABSTRACT**

*For many years, occlusal splint therapy has been used for the diagnosis and treatment of various masticatory system and temporomandibular joint disorders. Oral parafunction, unstable occlusion, symptoms of stress-related pain, occlusal interferences and extensive restorative treatment are the most common conditions requiring occlusal splint therapy. The aim of this article is to introduce the basic physiology of occlusal splint therapy for the treatment of temporomandibular disorder (TMD), bruxism, and certain forms of headache.*

*Keywords: Occlusal splints, splint therapy, masticatory dysfunction, temporomandibular disorders*

## **INTRODUCTION**

In the treatment of temporomandibular joint disorders and masticatory system dysfunction, interocclusal orthopaedic appliances or splints are routinely used. Hard or soft removable acrylic appliances that cover the teeth are used for various applications such as to remove occlusal disharmonies, prevent wear and mobility of the teeth, minimise bruxism and oral parafunction, treat masticatory muscle dysfunction, and correct derangements of the TMJ. For improved strength and athletic efficiency, mandibular orthopaedic repositioning appliances (MORA's) have been suggested.[1]

A reduction of pain with splint therapy is well known. Many studies have recorded symptom resolution following a splint therapy. Clark discussed the nature, theory and efficacy of particular symptoms of orthopaedic interocclusal appliances in a pair of articles published in 1984.[2][3] He reviewed literature through 1980 and noted that there is a 70-90 percent clinical success rate in the treatment of temporomandibular dysfunction with splints in general. Although the treatment effect is predictable, less is known about the explanation of the physiological basis of the treatment response. The aim of this paper is to discuss the effects of splints on muscle behaviour, changes in the tooth, and the TMJ.

## **Effect Of Splint Therapy On Muscle Physiology**

The nature of the occlusal system and specific tooth contact influences muscle function. The splint therapist can control which teeth contact at which mandibular movement. The modifications in muscle activity that follow changes in occlusal patterns must be understood so that better decisions can be made in the design of a splint.

Wood investigated voluntary maximum clenching in humans.[4] With the splint modified for various tooth contact patterns, he tracked the activity of the masseter, the anterior temporal and posterior temporal muscles using an EMG. Clenching with complete contact of all teeth on the splint, increased the activity of the EMG primarily in the masseter. He observed no difference in muscle activity when the splint was reduced so that there were no contacts from the central incisor to the first molar on one side. Electrical activity dropped further when the second molar occlusal contact on the same side was eliminated. Some subjects reported discomfort during the clench in the joint on the side with no contact.

Miralles showed similar results with a three-piece maxillary splint.[5] One section covered the centrals and laterals, the others covered from the canine to the second molar. Elimination of

bilateral or contralateral posterior sections of the splint decreased activity of the masseter and anterior temporal muscles, while ipsilateral removal had no effect. Removing the anterior section also had no effect. It is evident that in centric relation with maximal clenching, the location of teeth in contact has more influence than the number of teeth.

Different occlusal protrusive functions also influence elevator muscle activity. Miralles adjusted a flat plane maxillary splint to protrusive group function with no posterior contact and canine guidance in laterotrusion movement.[6] If maximum voluntary clench represented 100 percent of EMG activity, a protrusive clench with group function had 57 percent of maximal EMG for the masseter and 36 percent of the anterior temporal muscle. When only the canines contacted the percentage was slightly less. If protrusive contact was limited to the four incisors, activity reduced further. Protrusion reduces elevator muscle activity but the number of contacting teeth is the most significant factor in this reduction.

Williamson and Lundquist demonstrated that a splint limiting excursive contacts to the anterior teeth shut down the masseter and anterior temporal muscle activity that normally occurred with posterior tooth contact. They concluded that anterior guidance was necessary to reduce muscle activity. [7]

Unfortunately, most splint studies have been limited to the use of surface electromyography. The use of intramuscular electrodes would be a better option to study the activity of all of the masticatory muscles.

### **Increased Vertical Dimension And Muscle Function**

Most splints alter the vertical dimension of occlusion and increase the functional length of muscles. The muscular length that develops maximum tension is defined by physiologists as the resting length. It has been assumed that the clinical rest position (postural position) would be the vertical dimension of minimal muscle strain. The elevator muscles are assumed to be the most relaxed at rest. Rugh and Drago, in their study using surface electrodes and a kinesiograph, reported that as the vertical dimension increases from occlusal contact, muscular effort decreases. [8] Insertion of a splint usually increases the vertical dimension. The elevator muscles are more efficient at a functioning length greater than the vertical dimension of occlusion. The postural position of minimal muscle activity is at a larger vertical than clinical rest position. Thus, interocclusal splints that increase the occlusal vertical dimension beyond the freeway space cause an immediate adaptation to a new freeway space at an increased vertical dimension. [9] Therefore, the increase in vertical with a splint allows a muscle to function more efficiently during contact and be less active during postural functions. Furthermore, if TMD symptom relief is related to muscle activity reduction, then a thicker splint should have a greater therapeutic effect. Mann treated TMJ pain patients with flat plane splints of one millimeter, four millimeters, and eight millimeters in thickness. While splint thickness had no relationship to clicking reduction, the thinner splints took longer to reduce the pain symptoms. [10]

Adaptive changes may occur with long term increases in vertical dimension. Increase in a muscle's length, for example, with growth, stimulates addition of sarcomeres to the myofibril. Splint therapy may have a similar effect. Long term increase in vertical dimension may change a muscle's anatomical configuration. [11]

### **CONCLUSION**

Occlusal splint therapy has been very effective for the treatment of various disorders of the masticatory system and temporomandibular joint. Evidence suggests that bilateral, even contacts balances right and left muscle contraction and reduces pain of muscle origin. In protrusive and lateral function, reducing the number of contacting teeth reduces muscle activity but no such effect in bilateral contacts. The elevator muscles are more functionally efficient at a length when the vertical dimension is greater than the postural rest position. Interocclusal splints that increase the occlusal vertical dimension beyond the freeway space cause an immediate adaptation to a new freeway space at an increased vertical dimension. The EMG activity of the postural muscles is reduced with an increased vertical dimension of occlusion.

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