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Vitality of occlusal splint therapy

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Abstract

Splint therapy is a very useful tool in relaxing the pain of temporomandibular disorders and bruxism. This article presents a review of literature of the mechanism of action of splints and its implication in the temporomandibular disorders.

Dr. Peter Dawson says ^[1] "Dentists are the physicians of masticatory system." and it is the responsibility of a dentist to be familiar with basic principles of Occlusal splint therapy for the treatment of temporomandibular disorders, bruxism and other forms of facial pain and headache.

Keywords: Occlusal, temporomandibular disorders, masticatory system

Introduction

Occlusal splint theory is 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." ^[2] A properly constructed splint facilitates a mutually protected occlusion. ^[3]

Splints can be broadly classified as:

- I) Permissive
 - II) Non Permissive
 - III) Hydrostatic and
 - IV) Rubber (Silicon) Splints.
- I) Permissive Splints ^[4] are designed so as to allow the teeth to move or glide unimpeded over the contacting or biting surfaces. Examples of permissive splints are

- A) Bite Plane
 - 1) Anterior deprogrammer
 - 2) Lucia jig
 - 3) Anterior Jig

- B) Stabilizing Splints
 - 1) Tanner
 - 2) Centric relation
 - 3) Flat planes
 - 4) Superior repositioning

- II) Non-Permissive also called as directive splints are designed with the ramps and indentations by which the movement of mandible is restricted.

Eg.

- 1) Anterior or repositioning appliances (ARA).
- 2) Mandibular Orthotic repositioning appliances (MORA).

- III) Rubber Splints and hydrostatic splints include

- a) Aqualizer
- b) Jumar Corp

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These splints separate the teeth. As the splints are not balanced due to their rubber like property, these splints exacerbate bruxism, and these splints have posterior premature contacts.

Functions of Splints

The main functions of splints are:

- a) Relaxation of muscles
- b) Seating the condyle in CR
- c) For providing diagnostic information
- d) It protects teeth and other structures from Bruxism.
- e) To mitigate periodontal ligament proprioception
- f) Reduces cellular hypoxic levels.

1). Relaxation of muscles

Studies have shown that lateral pterygoid muscle is hyperactivated whenever there is tooth interference in the centric relation arc of closure, and closing muscle gets hyperactivated whenever there is tooth interference due to extrusive mandibular movements^[5, 6]. This elevator muscle hyperactivity is reduced by eliminating the posterior excursive contacts by anterior guidance^[7]. The coordinate muscle activity can show changes even by 50 μ m small occlusal interference^[8]. Headache which is a common symptom of TMD patients can be significantly reduced by the use of splint therapy^[9, 10]. Nociceptive trigeminal inhibition (NTI) splint which is a well-known anterior deprogrammer has been approved by FDA for the prevention of Migraine headache^[11]. Muscle relaxation is obtained with the use of occlusal splints by providing a platform for the teeth, so as to allow the equal distribution of tooth contacts and by immediate posterior tooth disclusion in all monoments using anterior guidance.

2). Seating of condyle in centric relation.

CR is the most stable position for determining the relationships of the bones, muscles, ligaments, disc and teeth. When the superior belly of lateral pterygoid muscle is in full extension due to minimal positioning muscle hyperactivity the condyle/disc assembly seats in CR. Temporomandibular joint is a load bearing joint especially during parafunctional activities and forceful biting or mastication^[12-14]. The temporalis and masseter muscles are the main elevator muscles to exert maximal force, while loading, when lateral pterygoid muscle and disc is totally relaxed in its physiological position. Any type of hyperactivity of lateral pterygoid muscles due to occlusal stimuli pulls the disc antero-medially towards the origin of muscles resulting in displacement of condyle/disc assembly, which leads to the damage of disc, muscles ligaments and condyle head. The overloading of condyle/disc assembly which can be acute or chronic out of physiological limits lead to the development of TMD. Now the function of splint is to provide the occlusion with the properly relaxed elevator muscles which in turn allows the condyle/disc to remain in anterosuperior position over the CR as physiological position. In case when there is pain of the joint due to the inflammation the condyles are placed in antero-inferior position till symptoms of pain subside so as to achieve CR.

A study was done on monkeys by Curtis Etal^[15] where splints were designed so as to provide deviation from the centric arc of closure. The result of the study showed marked changes in the density of condyles of monkeys. While no change was found in the monkeys which were positioned in CR. The result of the study was cartilage breakdown and arthritis in condylar heads due to the pressure of the condylar heads^[16].

3) Providing diagnostic information

Splint therapy is a useful diagnostic tool for restorative dentistry. Wearing a splint gives the information about the TMD status, bruxism habits and wear pattern. Whenever splint is given to a patient the splints show wear pattern which can be reintroduced in natural dentition after stopping the splint therapy. Different people show different occlude schemes depending upon the chewing habits which varies with people having horizontal grazing pattern and vertical chopping bite.

A study was done by Holmgren etal^[17]. to assess the wear pattern in the patient with bruxism by placing hard acrylic resin splints the results revealed the 13% of subjects showed something clenching, 71% subjects showed unilateral excursions and 3% subjects showed protrusive movements. Wear patterns obtained on splints gives information about the envelope of function, neutral zone, axial loads, occlusal configuration, choice of material to be used, cusp heights and shapes and guidance angulations to be introduced in restoration. Splint therapy also reveals the anatomical and physiological status of the TMJ. If the symptoms are rapidly improved it means the problem was muscular. But if the problem worsens with use of permissible splints it can be diagnosed as internal derangement of disc or a wrong diagnosis of the condyle and disc assembly.

4) Protecting teeth and associated structures from bruxism.

Bruxism is defined as "grinding or clenching of teeth at other times than for the mastication of food". Lots of studies has been done to find the force of bruxers and all the studies revealed the nocturnal force of clenching is always much higher than the normal day clenching. The occurrence of bruxers varies from 6.5% to 88%^[18]. The average clenching force in humans has been recorded 162 lbs/sq. Inch while as it is 6 times more in bruxers. Gibbs etal^[19] has recorded highest clenching of bruxers to be 975 lbs/Sq. Inch which is much more harmful than day chewing. As per the study carried out by the Holmgren^[17] the splints do not stop the bruxism habit but it distributes the force uniformly. Before doing the restorative treatment the Bruxism should be identified and the signs and symptoms should be encountered.

5) Mitigation of PDL proprioception

Each tooth root is covered by periodontal ligament, this periodontal ligament connects the nerve fibres which receives the stimulation from the biting forces and this message is sent to central nervous system which in turn triggers the muscles to counter the force and protect the teeth and Stomatognathic structures from over loading. Splint redistribute the forces by covering over a large surface of teeth. It balances the proprioception and even reduces it. Regular adjustment and modifications of splints are required to obtain uniform contacts and balance. As per the study done by Hannametal^[20] jaw opening was observed in cats on the stimulation of pressure receptors in periodontal membrane.

6) Reducing cellular hypoxia levels.

A study done by Nitzan^[21] to differentiate the capillary perfusion with and without the use of plane occlusal splint and revealed that without splint the capillary pressure exceeded 200mm of the whole as the pressure reading with splint was less than 20mmHg. The compensation of vessels leads to reduced blood supply of the affected one and hence affects its healing and normal functioning.

Theories of action of Splint theory by OKESON^[22]

The one mechanism of action in reducing the TMD symptoms using splints is not clear but different theories that try to explain the mechanism behind the action of splint therapy are as under

- 1) Occlusal Theory^[23, 24] As per this theory the premature contacts and occlusal interferences which result in the dysfunction of Craniomandibular system are excluded by obtaining the minimum intercuspation between maxillary and mandibular arches with the help of occlusal splints. This results in the change in the proprioception message sent by the periodontal ligaments to central nervous system which in turn relaxes the hyperactive muscles.
- 2) High Interoclusal relation theory^[23, 24]. Increasing the interocclusal distance temporarily and within physiological limits reduces bioelectrical activity i.e isometric contraction of the elevator muscles of mandible by stretching of muscle fibres. Hence reducing the symptoms of TMD.
- 3) Cognitive awareness theory^[23]. Muscle hyperactivity is reduced in bruxism with splint therapy, the exact mechanism is not clear. As per this theory people who have habit of bruxism may react differently on having a foreign body in their mouth and change their behaviour.
- 4) Mandibular repositioning theory this theory explains the functions of repositioning splints. As these splints change the maxilomandibular relation causing relief to the temporomandibular system. But this position should be reconstructed permanently as it is a temporary therapeutic position.
- 5) PLACEBO Theory^[23]. In some patients regular use of splints may reduce symptoms by placebo effect.
- 6) Increased peripheral input to the central nervous system decreases motor activity.
- 7) Regression of mean (Natural fluctuation of symptoms).

Clinical Implications of Splints

The treatment plan for the use of splints depends on the diagnosis after a thorough clinical examination which includes complete dental and medical history in all the patients especially those having bruxism, TMD or facial pain.

Patients having bruxism associated with headache without any organic cause for TMD can be treated with use of a simple full coverage head acrylic resin splint which is to be used for night only. This splint also relaxes muscles which also helps in relieving the symptoms. The type of bruxism habits dictates whether the splints should be given in upper or lower arch. Usually the maxillary guard with all the teeth in contact should be given in the patients clenching isometrically. The mandibular splint is more effective if the parafunctional movement is in or protrusive direction. Canine guidance is to be given in the patients having lateral parafunctional movement, where the anterior teeth are relieved.

The thickness of splint is used as an important criteria in the effectiveness of the therapy. As per Mann's et al^[25]. The best results in relieving the pain and relaxing the muscles of patients with bruxism were obtained using splints which increase vertical dimension of 4.4 mm to 8.2 mm as compared to the splints which are 1mm thick. According to Piper^[26] 12-15mm thickness of splint in incisal region can reduce the clenching efficiency. The conclusion of all the studies regarding the thickness of splint revealed that at least 4mm increase in vertical dimension should be given to protect the patient from bruxism. If the patient wearing 4mm thick splint

still complains of pain, muscle soreness, headache and facial muscle tightening immediately after waking then the thickness of the splint should be increased incrementally till the symptoms are relieved.

Now in the patient with TMD the selection of the splint depends on the diagnosis of the disorder. In case of muscle disorder the bite planes are the choice of splint. Hyperocclusion can result in the muscle disorder. Bite plane disoccludes the posterior teeth and allow the muscles to relax. Since these appliances separate the posterior teeth they should not be worn for more than 24-48 hours continuously. It can result in the supraeruption of posterior teeth. Stabilization splints can also be used. Since these splints have uniform contact there are no chances of super eruption and can be worn for a long period.

Patients with the complaint of joint click or pop associated with muscle symptoms are diagnosed as a combination of muscle and disc disorder. These types of disorder are more damaging and are more chronic in nature. The treatment of choice for such patients is full coverage stabilization splints which can be worn continuously for 24 hours except when eating. These splints can be worn for a period of 3 to 6 months so as to eliminate tooth, muscle ligament and disc symptoms. Such disorders bear good results if diagnosed early and treated properly.

Patients who experience in jaw locking and/or noises, painful joints and increased pain with splint therapy are diagnosed as advanced disc and muscle disorders. 7 to 10 day therapy with anterior repositioning splint may be useful in the patients with acute trauma. This splint keeps the condyle away from retro disclosure tissues so as to subside the inflammation. Such patients often complain of joint pain, locking and instability. The treatment of choice is stabilizing splint for a period of 6 months to 2 years. These disorders are usually irreversible but splint therapy can relieve symptoms.

Maintenance of Splint Therapy

The maintenance of the splint therapy is very important for the successful treatment. As per Holmgren et al^[17] 6% of patients showed occlusally induced changes in the form of indentations on the splint when splints were observed every 2 weeks. Rest of 39% also showed changes but at different times. These studies revealed that more than half of the patients require follow up appointments within 2 weeks. As per the protocol the splints should be adjusted at an interval of 24hrs, 3 days, 7 days, 14 days, 21 days and one month. When no changes are seen in the splint on follow up and patient experiences relief from symptoms the interval for the appointments can be increased and the patient can be advised to recall if symptoms worsen. The splints should be inspected regularly and adjusted to obtain uniform occlusal contact of all the teeth.

The knowledge about the splints and its implications and very vast but still incomplete. The decision about the use of splint is as complex as the temporomandibular joint itself. But still lot of patients are benefited with the use of these splints when diagnosed and maintained properly and in a number of cases the surgeries can be avoided.

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