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RESEARCH ARTICLE

AN INSIGHT INTO THE OCCLUSAL SPLINT THERAPY FOR THE MANAGEMENT OF TEMPOROMANDIBULAR JOINT DISORDERS

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Abstract

For many years the occlusal splint therapy has been practiced for the diagnosis and treatment of various temporomandibular joint disorders. Many designs have been discussed in the literature. Each of these occlusal appliances are used for specific conditions. A proper examination and diagnosis is essential for selecting the appropriate appliance for that particular situation. This article reviews about the types, designs and materials used for occlusal splint fabrication. The present article also familiarizes the individual application and uses of each occlusal splint.

Introduction:-

The Temporomandibular joint (TMJ) is the joint located between the lower jaw and the base of the skull. TMJ disorders (TMD) mentions to a group of disorders having symptoms like pain, joint sounds (clicking, grating), and limited or asymmetrical jaw movement that may have an effect on the quality of life. TMDs are also known as Craniomandibular disorders (CMD) which is considered as one of the most frequent causes of facial pain.[1]

TMDs can be treated by different modalities. They are categorized as conservative and surgical approaches. Under the conservative approach it includes physical therapy, localized steam application, external muscle massage (Reisine and Weber, 1989), occlusal adjustment (Lundh et al., 1988), analgesia, psychotropic medication (Greene, 1992), splint therapy (Kafas et al., 2007b), alternative therapies such as acupuncture (List et al., 1993), and other treatment options like ultrasound, soft laser, diathermy, and infrared radiation (Mohl et al., 1990) have also been utilized to treat TMDs.[2]

Definition

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]

According to GPT 9 occlusal splint is defined as any removable artificial occlusal surface affecting the relationship of the mandible to the maxilla used for diagnosis or therapy; uses of this device may include, but are not limited to, occlusal stabilization for treatment of temporomandibular disorders, diagnostic overlay prior to extensive intervention, radiation therapy, occlusal positioning, and prevention of wear of the dentition or damage to brittle restorative materials such as dental porcelain.[4]

Classification

According to Okeson[5]

1) Stabilization appliance

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2) Anterior repositioning appliances (ARA)/ Mandibular orthopedic repositioning appliance (MORA)
Other types:
a) Anterior/Posterior bite plane
b) Pivoting appliance
c) Soft/ resilient appliance (silicone)

Dawson classified splints as:
1. Permissive splints/ muscle deprogrammer.
2. Non-permissive splints/ Directive splints
3. Pseudo permissive splints (e.g. Soft splints, Hydrostatic splint)

Functions of Occlusal Splints
Well fabricated occlusal splints have mainly 6 functions, they are as follows:
(1) To relax the muscles of mastication, (2) to permit the condyle to seat in Centric Relation, (3) aids in diagnostic purpose, (4) to protecting teeth and other related structures from parafunctional habits like bruxism, (5) to mitigate periodontal ligament proprioception, and (6) to minimize cellular hypoxia levels.[3]

Occlusal Splint Materials
Based on the consistency, there are two materials which are commonly used for fabricating the occlusal appliances. They are hard acrylic resin and soft or resilient occlusal appliances. The hard acrylic resin Occlusal appliances can either be self-cured (by chemical reaction) or heat cured, resulting in hard and rigid tooth-borne and occlusal surface. Whereas, soft or resilient occlusal appliances are flexible and are having a pliable tooth-borne and occlusal surface. The combination of the above mentioned two materials is the third variation and is called as dual laminated, as its occlusal surface comprise of hard acrylic resin and the tooth-borne surface consist of a soft material. This type of occlusal appliances have advantages of a soft material (fitting well and ensuring comfort for the supporting teeth), and an adjustable occlusal surface of the hard acrylic resin.[6]

Hard acrylic resin occlusal appliances can be either custom fabricated at chairside or can be indirectly fabricated in the dental laboratory with the help of stone casts. The soft occlusal appliances ("boil and bite") can be purchased readily from dental supply houses and can be molded and adapted by boiling the product in water and then placing the material intra-orally with a biting force to establish proper occlusion. Soft occlusal appliances can be directly fabricated in the dental office, in which the material is vacuum formed to fit in the stone casts, and then the occlusion is later established at chairside. A third variation involves a similar processing technique which is done at a commercial laboratory and then the occlusion is established at chair side.[7]

Oral Appliances for Treatment of TMD
Flat Plane Stabilization Appliance (Michigan splint)
This appliance is also known as the gnathologic splint, Michigan splint, or muscle relaxation appliance. It is usually fabricated in the maxillary arch, but considering the esthetic factor and to avoid the interference with phonetics, it was recommended by some clinicians that the splint can be fabricated in the mandibular arch also. Turp et al had done a systematic review, and based on the results he concluded that there is no differences in reduction of symptoms irrespective of the location of the splint, either in maxilla or mandible. The objective of stabilization appliance as outlined by the American Academy of Orofacial Pain guidelines is to"allow the joint stabilization, protect the teeth, dissipate the occlusal forces, alleviate the elevator muscles, and reduce bruxism." Along with this, it was stated that "the patient's awareness to the jaw habits is increased by wearing this appliance and helps to bring the mandible to a more relaxed and open position from the rest position".[1]

Anterior Bite Plane: Traditional Anterior Bite Plane
These appliances are fabricated as a palatal-coverage horseshoe shape with an occlusal table engaging 6 or 8 anterior maxillary teeth. These appliances are able to treat TMDs as they prevent clenching, as the posterior teeth are not involved in the functional or in Para-functional activities. The common adverse effect of this appliance is the supraeruption of posterior teeth, if used only at nighttime and the TMJs getting overloaded when the posterior support is lost.[1]

Anterior Bite Plane: Mini Anterior Appliances

This oral appliance engages only 2-4 maxillary incisors.[1]An electromyographic study was done by Becker to evaluate clenching forces in various sites of the jaw. It was found out that the clenching force was maximum when molars occludes or contacts which is around 100% , on the other way it was 60% with cuspids and it was found minimum when the incisor contacts which was noted to be around 20%.[8]

This splint is used to prevent parafunctionl movement. It eliminates the clenching forces over the posterior area as there is no contact between the posterior teeth. When there is a muscular disorder due to the excessive loading on the musculature and hyperoclusion, bite plane therapy must be followed as this will relax the musculature. Anterior bite plane therapy is usually recommended in patients who having muscle pain either acute or chronic type. Nociceptive trigeminal inhibition (NTI) splint, Lucia Jig are the type of appliances included in this category.[9]

As this appliance involves only the anterior teeth there are chances of supraeruption of the posterior teeth which can lead to anterior open bite. Also, there are possibility for the intrusion of the upper anterior teeth. This has been considered as a major concern of using this appliance for a continuous and long term as it causes reverse occlusal changes. Moreover, because of the single point contact of this appliance, the upper teeth can get displaced by the occlusal forces or by the lower teeth which leads to mobility of the anterior teeth.[9]There are also some dangerous possibilities like swallowing of this tiny appliance.[10]

Anterior Repositioning Appliance (Orthopedic Repositioning Appliance)

This appliance is used to change the maxillomandibular relationship, in such a way that a more anterior position is presumed by the mandible. Upon closing, the mandible shifts into a more forward position which is directed by a guiding ramp attached to the anterior third of maxillary appliance. This type of appliance is used for treating anterior disk displacement with reduction. The anteriorly displaced disks will return back to its normal position (recaptured).[11]There are evidences of permanent and irreversible occlusal changes with long term use of this appliance. Hence the anterior bite plane appliance must be used carefully for a short period of time as a temporary therapeutic measure to alleviate internal derangements pain.[11]

Neuromuscular Appliances (NMA)

Proponents of neuromuscular dentistry have recommended the use of jaw muscle stimulators with jaw-tracking machine to obtain an appliance having an ideal vertical and horizontal position of the mandible with respect to the cranium.[12]After using these appliances this concept advocated a dental reconstruction at the new jaw relationship.

Posterior Bite Plane Appliance (Mandibular Orthopedic Repositioning Appliances)

Mandibular Orthopedic Repositioning Appliances (MORA) are designed for the mandibular arch and comprises a bilateral hard acrylic resin table present over the mandibular molars and premolars. They are connected with a lingual metal bar. By wearing this appliance it creates anterior disocclusion. These appliance is meant to supply horizontal maxillomandibular relationship and vertical dimension changes. Some authors have claimed that by improving the overall physical strength, this appliance may enhance the athletic performance.[13, 14]

As the posterior bite plane appliances produce an “ideal” maxillomandibular relationship, proper occlusal procedures have to be done in order to maintain that ideal relationship permanently. This appliance makes contact with the posterior teeth only, which could lead to overeruption of the anterior teeth or intrusion of opposing posterior teeth and ends up in posterior open bite.[15]

Pivot Appliances

The pivoting device is made with hard acrylic resin and forms a single point posterior contact which covers the maxillary or mandibular arch and is positioned as far posteriorly as possible, in each quadrant. The appliance is recommended for treating patients with internal disc derangements or intracapsular inflammation. It decreases the intra-articular pressure by condylar distraction which results in unloading the articular surfaces of the joint as the mandible fulcrums around the pivot. However, studies have proven that there is no such distractive effect on the temporomandibular joint by the pivoting appliances rather it creates compression of the joint. A modified version of this appliance was developed with a unilateral pivot positioned in the posterior region, hence when mandible closes on this pivot it will load the contralateral joint and there is a slight distraction on the ipsilateral joint. But this can cause potentially adverse occlusal changes as a posterior open bite in pivot area.[16]

Hydrostatic Appliance

This appliance was originally designed by Lerman over 30 years ago.[17]Its commercial name is Aqualizer. It is known as hydrostatic appliance as it has bilateral water filled plastic chamber occluded with the posterior teeth. These chambers are attached to an acrylic palatal plate.Various forms are available like the Aqua splint mini, Aqua splint classic and Aqua splint ultra.[17]A modified design of this appliance was developed in which it is retained under the upper lip. The mechanism of action is that the ideal position is identified by the mandible itself and the device was not directing the jaw to rest position. But there is no evidence supporting this claim till date.

Soft rubber splint

A vacuum pressure molding device is utilized for the fabrication of the soft rubber splint, in which a 2mm thick resilient rubber sheet (polyvinyl sheet) is incorporated. This splint can be used for reducing pain or discomfort and myalgia. It will also prevent bruxism and clenching. Rubber splints are often used by athletes as a protective device.[9]

Summary of various occlusal splints[9]

Splints	Application of splints
Flat plane stabilizing appliance	1)Provides occlusal stability 2)Muscle relaxation 3) Deprogramming the mandibular position 4)Alter the vertical dimension
Anterior bite plane-mini anterior appliance	1)Reducing clenching 2)Minimizes parafunctional movement 3)Unloading of TMJ
Anterior bite plane-traditional anterior bite plane	1)Reducing clenching
Anterior repositioning appliance	1)Treating reciprocal clicking 2)Stabilizing the condyle disk relation 3)Prevention of retrodiscal tissue compression
Posterior bite appliance	1)supply horizontal maxillomandibular relationship and vertical dimension changes
Pivotappliance	1)Treating internal disc derangements or intracapsular inflammation
Hydrostatic splint	1)Mandibular repositioning
Soft rubber splint	1)Alleviate pain, discomfort and myalgia 2)Avoid bruxism and clenching 3)As a protective device for athletes

Conclusion:-

This article review about various occlusal splints which can be used to treat temporomandibular joint disorders. Before selecting the splint the clinician should have a deep knowledge about the dynamics of the masticatory system and should perform a complete examination of the TMJ and the associated structures. This assessment is very essential in order to select a correct appliance suitable to a particular condition with lesser complications.

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