Deprogramming devices are used to eliminate muscle engrams, prevent the activation of the neuromuscular avoidance mechanism, and allow the mandible to more easily achieve the CR position. While the concept of using deprogramming devices to record CR is widely accepted, controversy and variation in technique abound. It is important to distinguish between permissive and directive splints. It is important to bring the patient back to "round zero" lowering EMG activity in the masseter and temporalis muscles, and then proceeding with further treatment. However it is imperative to understand that results of splint therapy are temporary. A case where deprogramming was done prior to orthodontic therapy using modified Anterior Midline Point Stop (AMPS) splint is presented.

Introduction:

Occlusal splints prevent the existing occlusion from controlling the jaw-to-jaw relationship at maximum intercuspatation by becoming the occluding surface. The ultimate effect of the occlusal splint is accommodation of the condylar axis to the splint dictated jaw relationship. This may be beneficial or detrimental depending on where the condyle-disk assemblies must move to conform to the occlusion established on the splint.

There are only two basic types of splints - permissive and directive. Permissive splints permit the teeth to slide on a smooth surface so that condyles can move freely with no direction from inter-cuspal seating contours. Thus the neuromuscular reflex that controls closure into maximum intercuspatation is lost. The condyles are then allowed to return to their correct seated position in centric relation if the condition of the articular components permits. Therefore they eliminate the cause and effects of muscle incoordination. For this reason permissive splints are often referred to as muscle deprogrammers or superior repositioning splint.

Directive splints (Pull forward splint or Anterior Repositioning Splint) require the mandible to be directed to a specific position in order for definite intercuspatation to occur at the teeth. The positioning of the mandible may also be accomplished by contracting inclines against anterior teeth that direct the mandible to a particular position of closure. The sole purpose of a directive splint is to position or align the condyle-disk assemblies. Thus directive splints should be used only when a specifically directed position of the condyles is required. The only reason for using a directive splint is an inability of the articulation to function physiologically in its seated relationship. A healthy joint does not need to be directed to that position.

The concept of centric relation seems to have shown a paradigm shift in the course of the century and needs to be understood before any splint therapy is initiated. In the 1950's it was the most retruded relationship of the mandible to the maxilla when the condyles are in their most posterior unstrained positions in the glenoid fossa from which lateral movements could be made, at any degree of jaw separation. In the 1980's "RUM" the rearmost, uppermost and midmost position
was the definition of centric. According to the glossary of prosthetic terms, centric relation (CR) is the maxillomandibular relation in which the condyles articulate with the thinnest avascular portion of their respective discs with the complex in the anterior-superior position against the shapes of the articular eminences. This position is independent of tooth contact. This position is clinically discernible when the mandible is directed superiorly and anteriorly. It is restricted to a purely rotary movement about the transverse horizontal axis\textsuperscript{17-23}.

Masseter and Temporalis are the key players in the action of mastication. Muscular activity is independent of the occlusal scheme. However, the occlusal scheme modifies the forces generated by the muscular activity. Modifying the occlusal scheme sometimes alters the force vectors generated. The best application of occlusal splints seems to be in its application prior to any occlusal adjustment (orthodontics). It is important to bring the patient back to “round zero” lowering EMG activity in the masseter and temporalis muscles, and then proceeding with further treatment\textsuperscript{23-25}. However, it is imperative to understand that results of splint therapy are temporary and recurrent symptoms are likely to show up within 4 weeks of discontinuing the splint\textsuperscript{25}. Thus, use of splints is symptomatic treatment and for an orthodontist it acts to accomplish the balance within the muscles, can also facilitate procedures such as occlusal analysis or an adjustment to a patients bite. Thus in the second phase of the orthodontic treatment would relieve the occlusal dysfunction.

Case Report:

A 25-years old male patient (Fig.1) reported to the Orthodontic Clinic in the Department of Dental Surgery A.I.I.M.S. The patient complained of a single click in the right TMJ upon opening. He stated that his occlusion had never felt comfortable and now joint symptoms of click and pain were making it more difficult to function. Also clenching on his teeth caused increased tightness and pain on the right joint\textsuperscript{27}.

Examination revealed tenderness of right TMJ (score 1) and a single click at 4 mm of opening. The left TMJ was asymptomatic. Bitting on a single tongue depressor between the posterior teeth eliminated the click and pain\textsuperscript{27}. The occlusal examination (Fig.2) revealed the wear facet on the right maxillary canine and both upper central incisors with lower centrals in edge to edge bite. The lower third molars were impacted and the uppers were erupting beyond the occlusal plane. There was a CR to CO glide of 0.5 mm with anterior eccentric guidance. The patient exhibited normal mandibular movement and had a maximum comfortable opening of 38 mm. Neurormuscular examination revealed the right temporal and masseter muscles to be tender (score 1). Transcranial radiographs of the TMJ revealed no bony or functional abnormalities, and no other significant findings were disclosed in the history or clinical examination.

The patient was diagnosed to be suffering from TYPE 2: disk displacement with reduction and episodic catching\textsuperscript{26}. Extraction of all the third molars was advised and it was decided to go for a directive occlusal anterior repositioning splint and the AMPS splint was given to the patient. Prior to the construction the centric was recorded and interocclusal records for centric, lateral and protrusive mandibular movements were taken. Bimanual technique (Dawson)\textsuperscript{28} was used with fingers at right angles with upward pressure and thumbs on chin with downward pressure. The mandible was manipulated into pure hinge movement (romancing the mandible). This technique to record centric is accurate and has support in the literature. Interposing recording medium between occlusal rims made direct
interocclusal records (Fig 3 & 4). It is recommended because of its simplicity but accuracy is dependent on the clinical judgement of the orthodontist. Careful trimming of the interocclusal recording material is critical because the soft tissue is recorded in a compressed state. The stone casts record the soft tissue in an uncompressed state. The two areas that must be trimmed are the gingival tissues of the maxillary teeth (palatal) and the distal tissue of the terminal maxillary tooth. Elastomeric material is stable, easy to use and acceptable accuracy. Semi-adjustable Whip Mix articulator was used, along with arbitrary facebows for mounting the casts.

Fig. 3: Centric relation records

Fig. 4: Lateral and protrusive records

Anterior midline point stop:

An anterior midline point stop (AMPS) splint allows for a point stop, typically perpendicular to the long axis of the lower incisors, and ideally on the mesial incisal edges of the two lower central incisors. It aims to suppress the intensity of temporalis contraction in all habitual mandibular positions (suppresses intense parafunctional muscular activity and optimal condylar orientation).

The appropriate degree of vertical opening created by the AMPS is a function of the patient's original degree of incisal overlap and historical degree of lateral parafunction. For patients with >50% incisal overlap (usually having little history of lateral parafunctional movement) the point stop of the AMPS is relatively small, creating a millimeter or two of freeway space between the molars. In such cases canine occlusion is possible but highly unlikely. However for most patients AMPS must prevent posteriors and canine occluding in all excursive and protrusive movements. A flattened cusp tip of the canine tooth demonstrates a historic clenching of the canine teeth in excursive movement. Regardless of the freeway space between the molars the AMPS must ensure that the canine teeth cannot occlude in the excursive movement.

As the jaw opens from a slightly disoccluded state the temporalis contraction activity increases. Occasionally when the canines are disoccluded there is posterior palatal cusp interferences. However occlusal equilibration should be initiated after presenting symptoms resolve. This can be aided by adding an acrylic-disoccluding element but this might increase the vertical too far (Fig. 5). Caution must be exercised in patients showing aggressive habitual excursive movement or may follow the use of AMPS splint. In such patients as well as patients with class III malocclusion AMPS can be fabricated for the lower incisors with the disoccluding element on the maxillary incisors typically avoiding canine contact.

Fig. 5: Modified AMPS splint

If occlusal scheme permits it is preferable to use a mandibular AMPS for patient's daytime use for enhanced esthetics and compliance. In case of flared incisors, one should reshape and add acrylic to the disoccluding element to make the occluding surface parallel to the occlusal plane. In extreme cases slant the disoccluding element in such a way that it would provide resistance to protrusive movement. However if used therapeutically, the canine could easily occlude on the deprogrammer in an excursive movement allowing for a near maximal temporalis contraction. With the condyle being slightly translated the disc is at serious risk of strain, compaction and damage. This could be avoided by shifting the occluding contact point on the lower incisor by trimming the acrylic in contact
with the canine. One of the main advantages is that since it is not possible to use it in function, supraeruption of molars does not occur. Condylar repositioning occurs to resolve the symptoms.

It is important to realize that when parafunctional habits are primarily side to side (lateral pterygoid activity) the splint will reduce the intensity of activity thus reducing the strain on the joint. However when parafunction includes both horizontal (lateral) and vertical (temporalis) activity the result is excessive clenching and the splint would cause joint strain. In cases parafunctional habits are forceful in the vertical direction (temporalis) the splint would in fact increase the activity. An AMPS provides for anterior contact only and thus significantly reduces the contraction activity of the temporalis when compared to the natural dentition, and also prevents the occlusal scheme scenarios necessary to allow for strain on the joint and musculature, but only in a static position[16-33].

A modified AMPS avoids lower canine interference in parafunction and is thus most appropriate for therapeutic use and extends sometimes to the first premolar region (Fig. 5). The changes in the EMG activity pre and post deprogramming are shown (Fig. 6). The changes are 4 weeks following the use of the splint. The EMG activity of right anterior temporalis and masseter activity, pre and post deprogramming showed significant changes in function and parafunction.

**Fig. 6: EMG recording for changes in Ant. Temporalis and Masseter activity**

**Discussion:**

Type II disc interferences may occur due to chronic occlusal disharmony as a progression of class I interference, or micro or macro trauma causing elongation of discal ligaments, thus allowing slight freedom of the disc to slide on the condyle. Clenching tries to displace the disc anteriorly and medially. If the disc is able to assume a slightly anterior and medial position, the very next translatory movement will slide the condyle across a small area of the posterior border of the disc back to the thinner intermediate area. A click often accompanies this movement[34].

The symptoms are eliminated on biting on the tongue depressor as it prevents the condyle disc complex from returning to normal fully occluded position and thus maintains proper condyle disc relationship for movement. This also reduces the interarticular pressure and weeping lubrication will be exhausted[35]. Thus anterior repositioning splint would be indicated ahead of centric relation splint[36]. However once discontinued slowly it tends to allow the mandible to go back to the original position and occlusion can be reestablished with orthodontics[37, 38]. Exercises like opening with pure rotation for 15-20 mm and resistance opening and protrusive exercises would be helpful[39].

Thus for an orthodontist, muscle deprogramming acts to accomplish the balance within the muscles which facilitates procedures such as occlusal analysis, or an adjustment to a patients bite. In the second phase, the orthodontic treatment would relieve the occlusal dysfunction[39-42]. The AMPS splint acts as a potent weapon in the hands of an orthodontist when directive splint therapy is indicated.

**References:**


