TMJ Disorders and Occlusal Splint Therapy – A Review
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Abstract:
Interocclusal orthopedic appliances of varied design and application have been employed in the treatment of myofascial pain dysfunction (MPD) and temporomandibular joint disorders (TMD). These appliances provide the practitioner with a non-invasive, reversible form of intervention to manage the patient’s symptoms. Sufficient credible literature exists to help provide an understanding of and a treatment protocol for the use of splints for temporomandibular disorders and bruxism problems.

The aim of this paper is to review different treatment options and various appliances reported in the literature available for treatment of temporomandibular joint disorder. It will also provide the practitioner with useful information that may be of assistance in the prediction of outcome and success of splint appliance therapy.

Key Words: A Bite Guard, Night Guard, Inter-occlusal Appliances, Intra-Oral Orthotic, Anterior repositioning device etc.

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Introduction:
The stomatognathic system is a functional unit that performs masticatory tasks such as swallowing food, speaking and esthetics. The stomatognathic system consists of three main components, i.e. TMJ components, masticatory muscles, and dental occlusion. These components are interrelated and coordinated by the central nervous system.

TMJ dysfunction is a well known chronical orofacial pain often seen by dentists and other health care workers. Pain is one of the most common complaint seen among TMJ dysfunction patients. The pain is commonly originated from TMJ and masticatory muscle dysfunctions.

Temporomandibular Disorders: “Abnormal, incomplete, or impaired function of TMJ”. - a collection of symptoms frequently observed in various combinations first described by Costen (1934, 1937), caused by altered anatomic relations and derangements of the temporomandibular joint associated with loss of occlusal vertical dimension, loss of posterior tooth support, and/or other malocclusions.¹

Occlusal Splint/ Occlusal Device/ Orthotics: “Any removable artificial occlusal surface used for diagnosis or therapy affecting the relationship of the mandible to the maxillae. It may be used for occlusal stabilization, for treatment of TMJ disorders, or to prevent wear of the dentition.”¹

An occlusal appliance /a splint is a removable device, usually made of hard acrylic, that fits over the occlusal and incisal surfaces of teeth in one arch, creating precise occlusal contact with the teeth of opposing arch. It is commonly referred to as...
a bite guard, night guard, inter occlusal appliances, intra-oral orthotic, or even orthopaedic device.

These are extensively used in management of TMJ disorders. They show considerable control in myofacial pain, however no clear hypothesis about the mechanism of action has been proved.

It has more of diagnostic value, for example, if a patient responds favorable to an occlusal device then the response to the same restorative permanent treatment should be positive. So it serves as an important diagnostic value before going to fixed prosthodontic therapy.

**Principle:** Most occlusal splints have one primary function: to alter an occlusion so they do not interfere with complete seating of the condyles in centric relation.

**Theories of splint action**
- Occlusal disengagement theory
- Restored vertical dimension theory
- Maxillomandibular aliment theory
- TMJ reposition theory
- Cognitive awareness theory

**What Occlusal Splints Can Do?**
1. Stabilization of weak teeth: An occlusal splint can effectively stabilize weak or hypermobile teeth by the adaptation of the splint material around the axial surfaces.
2. Distribution of occlusal forces
3. Reduction of wear
4. Stabilization of unopposed teeth

**What Occlusal Splints Cannot Do?**
Occlusal splints cannot cause effects that are in violation of mechanical laws. Thus an occlusal splint does not unload the condyles. The popular claim that a posterior occlusal splint serves as a pivot for distraction of the condyles is in violation of facts of anatomy, laws of physics, and clinical data. (Fig 1)

**Figure 1** Occlusal splint dose not unload the condyle as the muscles of mastication act posterior to the splint

**Types:** According to Okeson
- Muscle relaxation appliance/ stabilization appliance used to reduce muscle activity
- Anterior repositioning appliances/ orthopedic repositioning appliance

**Other types:**
- Anterior bite plane
- Pivoting appliance
- Soft/ resilient appliance

**According to Dawson:**
- Permissive splints/ muscle deprogrammer
- Directive splints/ non-permissive splints
- Pseudo permissive splints (e.g Soft splints, Hydrostatic splint)
  - MORA – mandibular orthopedic repositioning appliance

**Types of Occlusal Splints:**
1. A permissive splint or
2. A directive splint

**Permissive Splints:** Are designed to unlock the occlusion to remove deviating tooth inclines from contact. The condyles are then allowed to return to
their correct seated position in centric relation if the condition of the articular components permits. Permissive splints are often referred to as muscle deprogrammers.

**Directive splints:** Are designed to position the mandible in a specific relationship to the maxilla. 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.

**Contraindications for Directive Splints:**
1. The condyle and the disk can be aligned correctly.
2. The correctly aligned condyle-disk assemblies can move to the most superior position against the eminentiae without derangement.
3. The disks can maintain their alignment with the condyles during function.

**Centric relation splint:** The CR splint is an interocclusal appliance that provide an occlusal relationship in the masticatory system that is considered optimal. The condyles in their most musculoskeletally stable position at the same time the teeth are contacting simultaneously with canine disocclusion of posterior teeth during eccentric movement. Goal of this treatment is to eliminate malocclusion that contribute to the presence of TMJ disorder. Indicated in muscle hyperactivity, myospasms or myositis and parafunctional activity associated with increased level of emotional stress

Patient report Temporomandibuler disorder that has either an etiologic or a contributing factor associated with parafunctional activity CR splint should be considered. A centric relation splint is a full arch hard acrylic appliance. Either arch can be use but maxillary arch provide more stability since all mandibular contacts can be achieved on flat surfaces. It is very difficult to achieve proper anterior contact and guidance with mandibular appliance. Verification that the condyle-disk assemblies are capable of normal function in the most superior position can be achieved on a tentative basis by testing in the following manner:

1. Load testing the joints with bilateral pressure
2. Clench testing with the teeth separated
3. Doppler auscultation

**Adjusting the CR Contacts:** The occlusal surface of the appliance is best adjusted by first marking the deepest area of each mandibular buccal cusp tip and incisal edge with a pencil. The acrylic surrounding the pencil marks is removed so the relatively flat occlusal surface will allow eccentric freedom. All contacts, both anterior and posterior, should be carefully refined so they will occur on flat surfaces with equal occlusal force.

**Adjusting the eccentric guidance:** The acrylic prominences labial to the mandibular canines are smoothed. They should exhibit about a 30- to 45-degree angulation to the occlusal plane and allow the canines to pass over in a smooth and continuous manner during protrusive and laterotrusive excursions. It is important that the mandibular canines move freely and smoothly over the occlusal surface of the appliance. If the angulation of the prominences is too steep, the canines will restrict mandibular movement and may aggravate an existing muscle disorder. (Fig 2&3)
Final criteria for the muscle relaxation appliance:
The following eight criteria must be achieved before
the patient is given the muscle relaxation appliance:
1. It must accurately fit the maxillary teeth, with
total stability and retention when contacting the
mandibular teeth and when checked by digital
palpation.
2. In CR all posterior mandibular buccal cusps
must contact on flat surfaces with even force.
3. During protrusive movement the mandibular
canines must contact the appliance with even
force. The mandibular incisors may also contact
it but not with more force than the canines.
4. In any lateral movement only the mandibular
canine should exhibit laterotrusive contact on the
appliance.
5. The mandibular posterior teeth must contact the
appliance only in the CR closure.
6. In the alert feeding position the posterior teeth
must contact the appliance more prominently
than the anterior teeth.
7. The occlusal surface of the appliance should be
as flat as possible with no imprints for
mandibular cusps.
8. The occlusal appliance is polished so it will not
irritate any adjacent soft tissues.

Instructions and adjustments: The patient is
instructed in proper insertion and removal of the
appliance. When bruxism is the problem nighttime
use is essential, while day use may not be as
important. When the disorder is retrodiscitis, the
appliance may need to be worn most of the time. It
has been demonstrated that myogenous pain
disorders respond best to part-time use (especially
night time use) while intracapsular disorders are
better managed with continuous use. If wearing
causes increased pain, the patient should discontinue
wearing and report the problem immediately for
evaluation and correction.

On certain occasions fabrication of a
mandibular muscle relaxation appliance may be
desirable. Evidence suggests that maxillary and
mandibular appliances reduce symptoms equally. The
primary advantages of the mandibular type are that it affects speech less and aesthetics may be better. 

Anterior Repositioning Splints: It encourages the mandible to assume a more anterior position to centric occlusion to provide more favorable condyle relationship in fossa. The condyle head being held in more inferior, anterior position it will mechanically persuade disk on top the condylar head position, that is more favorable condylar head position. This unloading of joint decreases the inflammation in the joint and range of mandibular movement increases with decrease in symptoms and signs of TMJ disorder.

The purpose of anterior repositioning therapy is fulfilled when the retrodisksal tissues have healed sufficiently to regain a backward pull on the disk. The fabrication of anterior repositioning splint is identical to the centric relation splint. It is especially important that the anterior guidance on the splint must disclude all posterior teeth in all jaw positions except centric relation. Once the function is again optimal, treatment consist of gradually eliminating the splint and returning the patient to preexisting condition (often with some conservative modification of occlusion)

**Indications:** To treat disc derangement disorders. Patients with joint sounds (e.g., a single or reciprocal click) can sometimes be helped by it. Intermittent or chronic locking of the joint (e.g., retrodiscitis). Some inflammatory disorders are symptomatically treated as slight anterior position is more comfortable position for mandible

**Simplified fabrication technique:** Like the muscle relaxation appliance, the anterior repositioning appliance is a full-arch hard acrylic device that can be used in either arch. The anterior stop is constructed and the appliance is fitted to the maxillary teeth.

*Locating the correct anterior position:* The key to successful anterior repositioning appliance fabrication is finding the most suitable position for eliminating the patient’s symptoms. The anterior stop is used to locate it. The patient is instructed to protrude slightly and to open and close in this position. The joint is revaluated for symptoms and the anterior position that spots the clicking, is located and marked with red marking paper. This contact is grooved approximately 1 mm deep with a small round bur. Self-curing acrylic is added to the remaining occlusal surface so all occlusal contacts can be established. The anterior stop must not be covered by the acrylic. This position is verified by opening and closing a few times.

**Adjusting the occlusion:** The difference with this appliance is the anterior guiding ramp, which requires the mandible to assume a more forward position to ICP. Flat occlusal contacts are developed for the posterior teeth, and the large lingual ramp in the anterior region is only smoothed. The ramp is developed into a smooth sliding surface so as not to promote catching or locking of the teeth in any position.

**Final criteria for the anterior repositioning appliance:** The following four criteria should be met by the anterior repositioning appliance before it is given to the patient:

1. It should accurately fit the maxillary teeth, with total stability and retention when in contact with the mandibular teeth and when checked by digital palpation. In the established forward position all the mandibular teeth should contact it with even force.
2. The forward position established by the appliance should eliminate the joint symptoms during opening and closing to and from that position.

3. In the retruded range of movement the lingual retrusive guidance ramp should contact and upon closure direct the mandible into the established forward position.

4. The appliance should be smoothly polished and compatible with adjacent soft tissue structures.

*Instruction and Adjustments:* Instructed to wear the appliance at night and during the day as needed to reduce symptoms. On occasion a patient may need to wear this appliance all the time depending on the severity of the symptoms. (fig -4)

![Fig 4- Anterior Reposing Splint](image)

*Anterior Bite Plane/ Anterior Jig Lucia Jig, Hawley with Bite Plane/ Anterior Deprogrammes:* (Fig - 5&6)

![Fig 5 lucia jig](image)

The anterior bite plane is a hard acrylic appliance worn over the maxillary teeth providing contact with only the mandibular anterior teeth. It is primarily intended to disengage the posterior teeth and thus eliminate their influence on the function of the masticatory system.

*Indications:* Muscle disorders related to orthopedic instability or an acute change in the occlusal condition.

*Disadvantages:* If the appliance is worn continuously for several weeks or months, there is a great likelihood that the unopposed mandibular posterior teeth will supraerupt and the result will be an anterior open-bite. Hence therapy must be closely monitored and used only for short periods.

*Posterior Bite Plane:* The posterior bite plane is usually fabricated for the mandibular teeth and consists of areas of hard acrylic located over the posterior teeth and connected by a cast metal lingual bar. The treatment goals of the posterior bite plane are to achieve major alterations in vertical dimension and mandibular repositioning. (Fig -7)
Indications: Severe loss of vertical dimension or when there is a need to make major changes in anterior repositioning of the mandible. Some therapists have suggested that this appliance be used by athletes to improve athletic performance. However, scientific evidence does not support this theory.

Disadvantages: Potential supraeruptopion of the unopposed teeth and/or intrusion of the occluded teeth. Constant and long-term use should be discouraged.

Pivoting Appliance: The pivoting appliance is a hard acrylic device that covers one arch and usually provides a single posterior contact in each quadrant. This contact is usually established as far posteriorly as possible. When superior force is applied under the chin, the tendency is to push the anterior teeth close together and pivot the condyles downward around the posterior pivoting point.

The pivoting appliance was originally developed with the idea that it would lessen interarticular pressure and thus unload the articular surfaces of the joint. Unfortunately, the forces of the elevator muscles are located primarily posterior to the pivot, which therefore disallows any pivoting action.

In fact, the pivoting appliance has been advocated for the treatment of symptoms related to osteoarthritis of the TMJs. For the treatment of an acute unilateral disc dislocation without reduction.

Soft or Resilient Appliance: Description and Treatment Goals: The soft appliance is a device fabricated from resilient material that is usually adapted to the maxillary teeth. Treatment goals are to achieve even and simultaneous contact with the opposing teeth.

Indications:
1) Protective device for persons likely to receive trauma to their dental arches
2) Protective athletic splints decrease the likelihood of damage to the oral structures when trauma is received.
3) Clenching and bruxism

Okeson demonstrated that nocturnal masseter EMG activity was increased in 5 to 10 subjects with a soft appliance; in the same study 8 of the 10 subjects had significant reduction of nocturnal EMG activity with a hard muscle relaxation appliance.

Common Treatment Considerations of Appliance Therapy: However, much controversy exists over the exact mechanism by which occlusal appliances reduce symptoms. Most conclusions are that they decrease muscle activity (particularly parafunctional activity). Before any permanent therapy is begun, one needs to be aware that there are six general features common to all devices that may be responsible for decreasing muscle activity and symptoms.
1. Alteration of the occlusal condition
2. Alteration of the condylar position
3. Increase in the vertical dimension
4. Cognitive awareness
5. Placebo effect: 40% of the patients suffering from certain TM disorders respond favorably to such treatment.
6. Increased peripheral input to the CNS: Any change at the peripheral input level seems to have an inhibitory effect on this CNS activity.

Summary

Despite the unanswered questions on the physiologic mechanisms that explain the effectiveness of intra-oral appliances on reducing symptoms of TMD, there is still a plethora of documentation that intra-oral appliance when used in the management plan accurately, can contribute to the relief of TMD symptoms. The clinician is encouraged to evaluate each particular patient case in an effort to develop a differential diagnosis that leads to effective management plan.

Before commencing any appliance therapy for a TMD, the clinician should be confident that the patient will benefit from the therapeutic approach. If the symptoms reduced that will provide additional diagnostic information. The clinician also needs to consider that 40% of patients suffering from TMD demonstrate favorable response to therapy from a placebo effect. As with any treatment, a good patient-dentist relationship and concomitant with patient education, can alloy patient feelings and anxieties.

It can contribute to a positive and favorable response to intra-oral occlusal splint therapy.

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