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SPLINTS IN PROSTHODONTICS – A LITERATURE REVIEW

Dentistry

Dr. Kumari Atulya Postgraduate Student, Department Of Prosthodontics, Rajarajeswari Dental College And Hospital.
Dr. Gautam Shetty Professor, Department Of Prosthodontics, Rajarajeswari Dental College And Hospital.
Dr. Shwetha Kumari Poovani Professor And Head Of The Department, Department Of Prosthodontics, Rajarajeswari Dental College And Hospital.

ABSTRACT

Occlusal splints are also called as occlusal appliances, biteguards, mouthguards, orthotics, interocclusal appliances. Occlusal splint therapy is used as both diagnostic and treatment appliance for temporo-mandibular disorders and occlusion related disorders. The aim of this article is to provide an insight on various types of splints being used in the field of prosthodontics, indications and the rationale for use.

KEYWORDS

INTRODUCTION:

Occlusal splints are needed in prosthodontic treatment planning and for the management of joint-muscle pain dysfunctions. Splints are used to relax the muscles, to allow the condyle to seat in musculoskeletal stable position, to provide diagnostic information, to protect teeth and associated structures from bruxism, mitigate periodontal ligament proprioception and cognitive awareness.[1] There are described many designs for occlusal splints, and the different types of splints are used to treat different conditions. Familiarity with application of splint therapy for patients with occlusal-related disorders can be one of the approaches for the treatment of affected individuals.[2]

USES OF SPLINTS:

These are some of the uses of splints according to their usage [3] -

- To hold together the fracture segments, provide stability, and promote healing - Gunning Splint.
- These are utilized to stabilize the deformities of stomatognathic system.
- To avoid complications like non-union, malunion of the fractured fragments.
- Direct the radiation; protect the vital tissues from radiation- Radiation Splint.
- Prevents the scar contracture after major surgeries of the head and neck patients
- They can carry medicaments.
- They stop hemorrhage and allow periodontal packing – Periodontal Splints.

SPLINTS FOR DENTULOUS PATIENTS:

Periodontal splints:

The periodontal splints are provided to decrease the mobility of the periodontally weakened teeth. The splint allows the wider distribution of occlusal forces.[4,5]

Fig 1: Periodontal splint

A. Depending Upon The Duration:

I. **Temporary splints**: Splinting with orthodontic wire and composite resins.
II. **Diagnostic or provisional splints**: Splinting done by using provisional restorations or the composite resins.
III. **Permanent splints (periodontal prosthesis)**: Splinting done by using acid etched bridges, continuous ¾ crowns, pin ledge type retainers.

B. Depending Upon The Relation To The Teeth:

I. **Fixed splints**:Acid edge bridges, continuous ¾ crowns, pin ledge type retainers.
II. **Removable splints**: Cast partial dentures with continuous clasps and / or with lingual plate and swing lock partial dentures.

Fig 2: Removable splints

C. Depending Upon The Relation On The Surface Of The Teeth:

I. **Intracoronal splints**: Continuous amalgam restorations, acrylic intra coronal splints reinforced with orthodontic wires and acid etched bridges.
II. **Extra coronal splints**: Cast partial dentures, Elbrecht splints and splinting with inter dental wiring.

Mouth Guards:

Around 32-52% of players engaged in contact sports sustain dentoalveolar fractures during the games.The mouth protectors are semi-rigid type of the occlusal splints which prevent the contact of the maxillary and mandibular teeth during a trauma and thus absorb the forces and protect the dentition and adjacent hard and soft tissues.[6]

Fig 3: Mouth guards

Occlusal splints for cheek biting habit:

Here the Occlusal splint is fabricated in such a way, that the

interocclusal part, is extended 3-5 mm beyond the maxillary buccal surfaces, thus it prevents the cheek or buccal mucosa from getting entrapped between the occlusal surfaces.[7]

Fig 4: Splint for cheek biting habit

SPLINTS USED IN DENTOALVEOLAR FRACTURES:
In dentulous patient: The occlusal surfaces of the teeth are the best guide for the reduction or realignment of the fracture fragments.[8]

Eyelet wiring:
The ligature wire (0.3 to 0.5 mm) is utilized to splint the teeth in the same arch. The eyelets are provided to immobilize the maxillary and mandibular arch, which are stabilized together using inter-maxillary fixation.

Splinting By Using Arch Bars:
The arch bars like Erich arch bar, Winters arch bar can be utilized along with ligature wires for splinting the individual arches and stabilizing them.

The arch bars reinforced with acrylic resin:
The arch bar is contoured on the realigned cast and it is stabilized by using the cold cure acrylic resin. The reinforced arch bar is utilized for stabilization and immobilization of the fracture fragments.

Cast cap splinting:
They provide rigid and efficient fixation of the fracture fragment. This splint may be capped or left open at the occlusal surface, or it may be hinged. Chromium cobalt, aluminium and gold are common metal used for construction of cast metal splint.[9]

Fig 5: Cast cap splinting

Lingual acrylic splints:
They are mainly utilized for stabilization of the mandibular fractures. Because of the adverse muscular forces, para symphyseal fracture of mandible tends towards lingual collapse and overlaps the fractured segments. Wire loops or arch bars alone that are applied on either side of the fracture line, frequently cannot control this collapsing tendency.

Fig 6: Lingual acrylic splint

Labiolingual splint:
The splint, consist of an acrylic band that fits around the labial and lingual aspects of the teeth, leaving the occlusal surfaces of the teeth uncovered. The continuity of the two flanges is secured by a stainless steel wire bent to form hinges which are placed bilaterally behind the last posterior teeth. -The labial flange is slint into two sections from the midline or from another suitable area. Two buttons approximately 5 mm in diameter are added at the labial segment 3 mm away from the splint line for the use in tightening and immobilizing the splint to the arch with stainless steel wire. This type of splint is ideal for cases with exostosis, for there is no need of blocking out the undercuts.

Fenestrated splint:
This is a one piece prosthetic device which is contoured to fit a dentulous maxilla and mandible through fenestrations created for the occlusal surfaces of the teeth. These types of splints are used for short permanent clinical crowns, for deciduous teeth when no undercut is available for retention, and for badly decayed teeth, as in post radiation caries.

Occlusal wafer splint:
It is generally used for intermaxillary fixation of fully dentulous patients who have occlusion that is inadequate for positive index. Although this splint is frequently constructed of acrylic, cast metal may be used when thickness and strength are critical. The occlusoincisal surface of both the arches is covered with splint, and immobilization is achieved with elastic bands.[10]

Fig 7: Occlusal wafer splint

Kingsley splint:
This splint was introduced by Norman Kingsley in 1880. The Kingsley splint, which is often fabricated for dentulous or edentulous patients, covers the palate and the ridge. The Kingsley splint resembles a metallic stock tray with two metallic wire extensions protruding bilaterally from the commisures of the mouth which are utilized to apply the pressure in a particular direction and also helps to stabilize the splint.

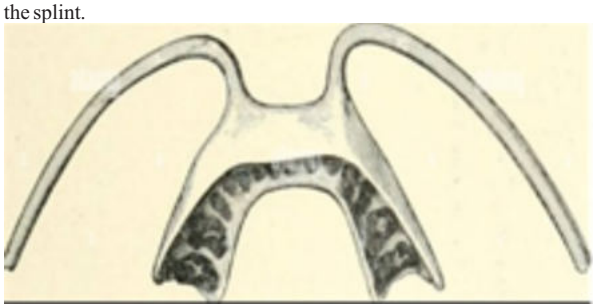


Fig 8: Kingsley splint

Cast metal splint:
When the long-term immobilization is needed then cast metal splints can be utilized for efficient splinting. The cast metal splints are usually recommended after orthognathic surgeries. Palatal occlusal splint is particularly useful for fixation of maxillary segmental osteotomy.[11]

Fig 9: Cast metal splint

SPLINTING IN EDENTULOUS PATIENTS:
Gunning splints:
The gunning splints are designed to immobilize edentulous or partially edentulous jaws after reduction. It holds together fractured segments

of mandibular or maxillary bones and immobilizes the jaws in occlusion. In case of edentulous patients no hard tissues will be available for stabilization and retention of the splints. The retention is mainly obtained by wiring to the underlying bony tissues.

One piece Gunning splint:
It consists of maxillary and mandibular record blocks which are fabricated at approximate vertical and centric relation records. The maxillary and mandibular blocks are joined together by cold cure resin and stabilized in oral cavity by different wiring.

Two Piece Gunning Splints:
In this type maxillary and mandibular parts are separate and they are joined by wiring or elastics with the help of hooks present on the buccal surfaces.[12]

Fig 10: Two piece gunning splint

Sectional Gunning Splints:
This is a type of the gunning splint, which is used to immobilize resected mandible to minimize post surgical deviation and to minimize the wound contracture. It is a two piece prosthesis with indexes to reorient and to prevent the sliding of the parts. A locking screw or the elastics can be used to for intermaxillary fixation.

Modified Gunning splint:
If the patient has complete maxillary and mandibular dentures, the incisors can be removed and used as splints with the addition of interdental wires. Three hooks are applied to anchor rubber bands, and buccal holes are drilled in the upper and lower bases to immobilize the splints to the arches.

Another modified gunning splint is made from fractured dentures. The fragments of the denture should be repaired and the incisors removed in the upper and lower dentures to make a modified gunning splint. Also holes are drilled for immobilization to one jaw. A possible alternative is to imbed arch bars into the facial aspect of the dentures.[13]

Oral commisure expansion splint /Burn splint:
Burn splint (Gay W.D. and Cjorhan 1984) :

The burn splint consists of two C-shaped acrylic blocks, which are connected by orthodontic expansion screw. The acrylic block is fabricated by recording the impression of the corner of the mouth. The orthodontic expansion screw is slowly activated to apply stretching forces at the corner of the mouth. After a period of 4 to 6 weeks there will be improvement in the amount of mouth opening.

Types of Occlusal Appliances:
*** As classified by Okeson.P :**[14]
-Stabilization Appliance
-Anterior Positioning Appliance
-Anterior Bite Plane
-Posterior Bite Plane
-Pivoting Appliance

*** As classified by Peter E Dawson:**[15]
- Permissive occlusal splints
- Directive occlusal splints

*** Depending upon the consistency:**[16]
- Hard acrylic splint
- Soft acrylic splint
- Dual laminated splint

Stabilization Appliance:
The stabilization appliance is generally fabricated for the maxillary arch and when it is in place, the condyles are in their most musculoskeletally stable position and at that time the teeth are contacting evenly and simultaneously. The treatment goal of the stabilization appliance is to eliminate any orthopedic instability between the occlusal position and the joint position.

Indications
- To treat muscle pain disorders. Thus, when a patient reports with a TMD that relates to muscle hyperactivity, such as bruxism, a stabilization appliance should be considered.
- It is helpful for patients experiencing retrodiscitis secondary to trauma. This appliance can help minimize forces to damaged tissues thus permitting more efficient healing.

Fig 11: Stabilization appliance

Anterior Positioning Appliance:
It may be useful for the management of certain disc derangement disorders since anterior positioning of the condyle may help provide a better condyle-disc relationship, thus allowing better opportunity for tissue adaptation or repair. An anterior stop is constructed and the appliance is fitted to the maxillary teeth. The acrylic extending over the labial surfaces of the maxillary teeth is not needed for occlusal purposes, it can be removed to improve aesthetics.The goal of treatment is not to alter the mandibular position permanently but only to change the position temporarily to enhance adaptation of the retrodiscal tissues. Once tissue adaptation has occurred, the appliance is eliminated, allowing the condyle to assume the musculoskeletally stable position and painlessly function on the adaptive fibrous tissues.

Indications
- It is used primarily to treat disc displacements with reduction and disc displacements with intermittent locking.

Fig 12: Anterior positioning appliance

Anterior Bite Plane:
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. Complications are that if the appliance is worn continuously for several weeks or months, there is a great likelihood that the unopposed mandibular posterior teeth will erupt. When this occurs and the appliance is removed, the anterior teeth will no longer contact and the result will be an anterior openbite.

Indications
- In the treatment of muscle disorders related to orthopedic instability or an acute change in the occlusal condition.
- Parafunctional activity may also be treated with it but only for short periods.

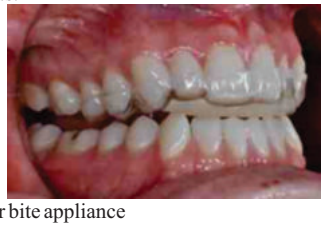


Fig 13: Anterior bite appliance

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 is connected by a cast metal lingual bar. The use of this device may be helpful for certain disc derangement disorders, although this appliance has not been studied well for this condition. Complications are that it allows potential supraeruption of the unopposed teeth and/or intrusion of the occluded teeth.

Indications
- In cases of severe loss of vertical dimension or when there is a need to make major changes in anterior positioning of the mandible.
- Some therapists have suggested that this appliance be used by athletes to improve athletic performance.

Fig 14: Posterior bite plane

Pivoting Appliance:
The pivoting appliance is a hard acrylic device that covers one arch and usually provides a single posterior contact in each quadrant.

Treatment Goals
- Teeth contact with the appliance 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.
- In a painful disc displacement patient that the pivot does not restrict the mandibular position, and therefore the patient may close and position the mandible more downward and forward to avoid the pivot.

Unilateral Pivot Appliance:
It can distract a condyle from the fossa, When a unilateral pivot is placed in the second molar region, closing the mandible on it will load the contralateral joint and slightly distract the ipsilateral one.

Fig 15: Unilateral pivot appliance

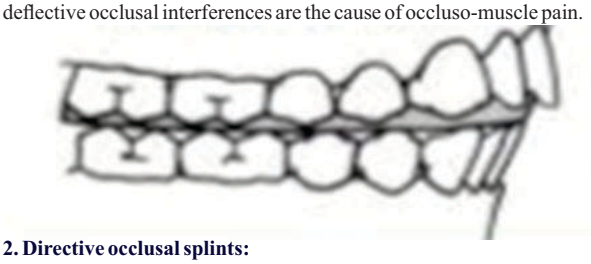
Soft or Resilient Appliance
The soft appliance is a device fabricated of resilient material that is usually adapted to the maxillary teeth. It is used to achieve even and simultaneous contact with the opposing teeth.

Indications
Most common and well-substantiated indication is as a protective device for persons likely to receive trauma to their dental arches.[16]

Fig 16: Soft splints

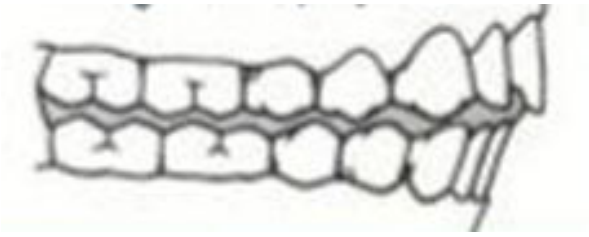
As classified by Peter E Dawson:
1. Permissive occlusal splints
They have a smooth surface on one side that allows the muscles to move the mandible without interference from deflective tooth inclines so the condyles can slide back and up the eminentiae to complete seating into centric relation. The smooth surface can face either the lower arch or the upper arch as long as it frees the mandible to slide to centric relation.

Anterior deprogramming splints:
It is the simplest type of permissive splint. If there are no intracapsular structural disorders in the TMJs, a correctly made deprogramming splint is very effective in getting patients comfortable, usually within minutes or hours. They are very effective in diagnosing whether deflective occlusal interferences are the cause of occluso-muscle pain.



2. Directive occlusal splints:
They direct the lower arch into a specific occlusal relationship that in turn directs the condyles to a predetermined position. Directive splints have very limited use. They should be reserved for specific conditions involving intracapsular TMDs.

Indications of anterior repositioning device:
- A disk that is partially displaced so that the condyle has been distalized on the posterior band of the disk may in some unusual situations benefit by moving the condyle forward to a more centered position on the disk.
- If complete reduction is possible but not maintainable, a directive splint may be used to position the condyle in the disk to prevent it from slipping back past the posterior band.
- Severe trauma with retrodiskal edema.



OTHER TYPES OF SPLINTS:
Nociceptive Trigeminal Inhibition–Tension Suppression System:
It is a small pre-fabricated anterior bite stop, which covers – in its most widely used form – the two maxillary (or mandibular) central incisors. Most articles have reported positively in the therapy of long-lasting headache or facialpain. This "miniature anterior bite appliance" is typically worn during the night, although two variations of the bite stop are offered for daytime use.

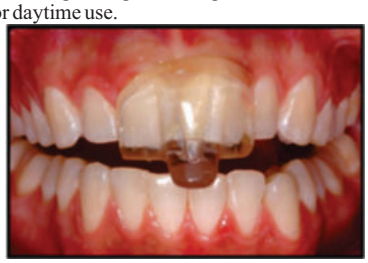


Fig 17: Nociceptive trigeminal inhibition tension- suppression system

Fig 18: Gelb splint

Gelb Splint:
The Gelb appliance is made in the lower jaw, covering only the

premolar and molar teeth. It is used to correct mandibular displacement, reduce temporomandibular joint dysfunction and oral/facial pain, and to provide occlusal stability with the patient's natural dentition serving as the anterior guidance.

Decompression Splint:

The decompression splint is used to treat posteriorly or superiorly compromised temporomandibular joints in which a pronounced constriction of the joint capsule, muscles, and ligaments interferes with the relief of the articular structures that would otherwise be provided by the occlusion. Its design corresponds to that of a relaxation splint with anterior guidance.

Fig 19: Decompression splint

Verticalization Splint:

It is made to create a calculated increase in a presumably inadequate vertical dimension and must be worn day and night. The purpose of a verticalization splint is to test the planned vertical dimension increase for neuromuscular acceptance before any permanent changes in the occlusion are made.

Fig 20: Verticalization

Distraction Splints:

The proposed effect is that the condyles are pulled downward upon clenching on the pivot, thereby relieving traumatic load and giving the disk freedom to reassume a normal position. It is used to unload the articular surface of the joint caused by decrease in inter- articular pressure, helps treating joint sounds or the treatment of symptoms related to degenerative diseases.

AQUALIZER

Use of Aqualizer™ is indicated in TMJ pain, headache, neck and shoulder pain and stiffness, orthodontic triggered muscle pain during treatment, presurgical differential diagnoses, postsurgical pain and inflammation. It has unique water system that immediately optimizes biomechanics, supports the jaw in a comfortable position, removes the teeth from dominance, placing bite and body in harmony, straightens the bite to maximize other structures, enables systemic functional balance, allows the body to naturally balance itself, finds perfect occlusal balance after starting the treatment immediately.[17]

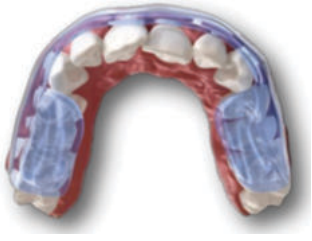


Fig 21: Aqualizer

CONCLUSION

Splints are considered to provide non-invasive and reversible treatment, they are therapeutic devices that conform well to the current philosophy governing protocols for therapy of the masticatory system. Proper design and placement of occlusal splints requires that they respond to precise indications and that practitioners fabricate and maintain them with scrupulous care to assure that patients benefit from them.

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