

Review Article

Periodontal Splints: Past to Present: A Review

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ABSTRACT

Tooth mobility is caused by the loss of tooth-supporting structures. Increased tooth mobility has a negative impact on function, appearance, and patient comfort. Splints are utilized to solve all of these issues. Splinting mobile teeth to stronger adjacent teeth is a possible solution when faced with the challenge of how to maintain periodontally damaged teeth. This extends the life of loose teeth and provides stability for the periodontium. Tooth stabilization and splinting have been used to reduce tooth mobility, replace lost teeth, and improve shape, function, and esthetics since ancient civilization. Conservative bonding treatments to splint teeth have become a popular option to more intrusive restorative operations in recent years. Splinting its, basic concepts, classifications indications, contraindications, limitations, and various splints from past to present are all discussed in this article.

KEYWORDS: *Splinting, stabilization, tooth mobility*

INTRODUCTION

Periodontal disease is a multifactorial disease caused by subgingival plaque, gingival inflammation, connective tissue attachment loss, and alveolar bone loss.^[1] Progressive attachment loss around the affected teeth leads to increased mobility, which can make it difficult to function. It is necessary to reinforce the supporting tissues, limit movement, and re-establish function in particular circumstances.^[2] Tooth movement can influence function, esthetics, and patient comfort in patients with moderate-to-severe periodontal disease.

Clinical care of the hypermobile tooth can be difficult, especially defining the etiology, whether it's owing to existing periodontal attachment loss or true occlusion-related damage. A poor periodontal prognosis is aided by occlusal stress and movement in the periodontally impaired dentition. Splinting therapy, on the other hand, can be used to regulate and manage tooth mobility.^[3] It is possible to splint movable teeth to stronger adjacent teeth. This extends the life of loose teeth, provides stability for the periodontium to heal, and enhances comfort, function, and esthetics.^[4]

DEFINITION

A splint has been defined as any apparatus, appliance, or device employed to prevent motion or displacement of fractured or movable parts.^[5]

The Glossary of Prosthodontic terms defines splinting as a rigid or flexible device that maintains in position a displaced or movable part; also used to keep in place and protect an injured part.

The second definition of splint used in this same glossary is a rigid or flexible material used to protect, immobilize, or resist motion in a part.^[6]

According to Glossary of Periodontic terms, it is an appliance designed to stabilize mobile teeth.^[7]

HISTORICAL PERSPECTIVE

Wire ligation and gold bands were used to support teeth by the Etruscans from the seventh century BC to the first century AD, according to archaeological excavations. Fauchard attempted tooth ligation in the early 1700s. Splinting techniques dating back to the early 1800s have been described by Litch. Gold wire was employed by Ottclengui (1889) to fix loose teeth.^[8]

Hirschfeld was one of the first modern periodontal authors to suggest the use of stainless steel wire or silk to ligature periodontally affected teeth.

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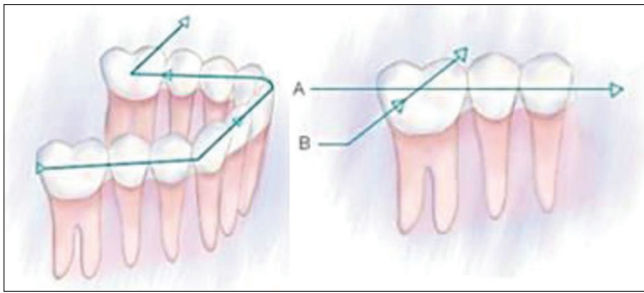


Figure 1: Principles of splinting



Figure 3: Wire ligature acrylic splint

Cutting grooves in the lingual aspects of anterior teeth and binding them together with acrylic resin was suggested by Obin (1951).

Nathan Friedman *et al.* employed a cemented and wired to anterior or posterior teeth cast buccolingual bar.^[9]

Alvarez found in 1993 that an injured tooth should be splinted to prevent continual movement that would impede the periodontal ligament's re-organization.^[2]

In 2000, Trope *et al.* indicated avulsed tooth requires semirigid splint of 7–10 days.^[2]

OBJECTIVES OF SPLINTING

- Splint therapy, in one form or another, provides occlusal rest, which helps to reduce or neutralise various occlusal force
- Occlusal forces are shifted in a more axial direction across all of the teeth in the splint^[9]
- Splinting increases resistance to the applied force by stabilization. As a result of the redistribution of forces, forces do not exceed their adaptive capacity
- Splinting restores proximal contact, which helps to prevent food impaction and subsequent disintegration^[9]
- Splinting improves masticatory comfort by restoring a functional occlusion, stabilizing mobile abutment teeth, and restoring a functional occlusion
- Splinting relieves the patient's discomfort caused by mobile teeth, resulting in a sense of well-being
- During surgical treatment to stabilize mobile teeth.^[9]

IDEAL REQUIREMENTS OF SPLINTS

- It should be simple, cost-effective, stable, and effective
- It is nonirritating and does not interfere with



Figure 2: Cast continuous splint



Figure 4: Occlusal splint

treatment

- Biologically compatible and esthetically pleasing^[10]
- It must not cause iatrogenic illness
- Should not cause entrapment of food
- Sturdy and long-lasting.^[10]

INDICATIONS

- To stabilize moderate to advanced tooth movement that has not responded to occlusal correction or periodontal therapy and cannot be decreased any other way
- In secondary occlusal trauma, stabilize the teeth^[10]
- After orthodontic movement, stabilize teeth
- Reduce tooth movement, which interferes with normal masticatory function
- Stabilize teeth following acute dental damage such as subluxation or avulsion
- Allows for easier scaling and surgical treatments
- Prevent teeth from tilting and drifting
- Prevent unopposed teeth from supraerupting.^[10]

CONTRAINDICTION

- Advanced tooth mobility
- Patient with a poor oral hygiene regimen
- Occlusal trauma has been decreased on a tooth

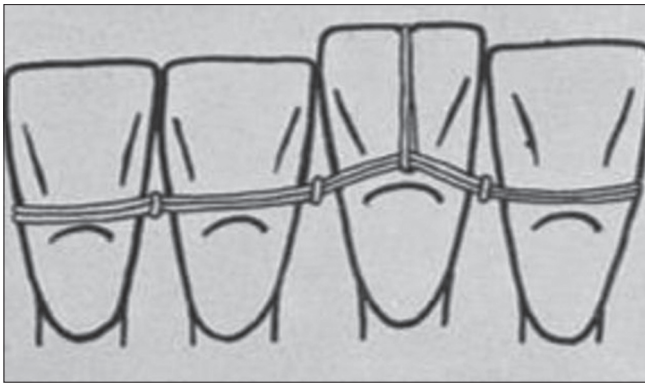


Figure 5: Wire ligature splint

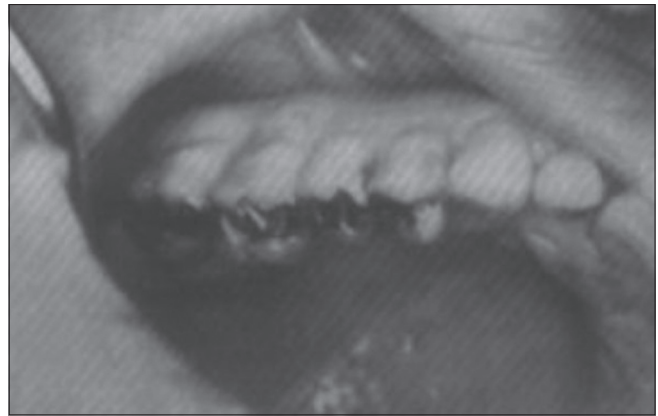


Figure 6: Wire and amalgam splint



Figure 7: Combined wire amalgam and acrylic splint

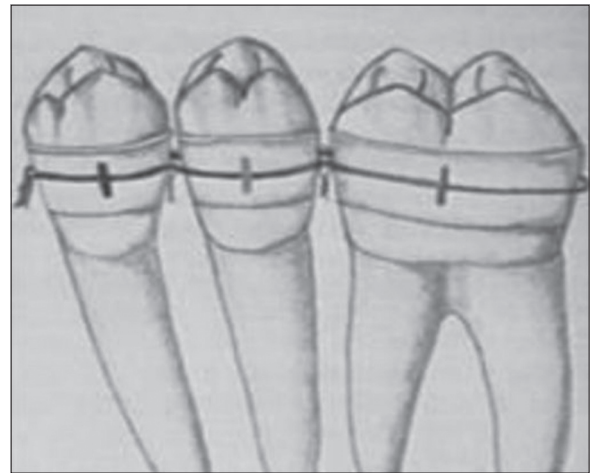


Figure 8: Wire band splint

- Inflammation and pathology in the teeth
- There are not enough firm teeth.^[10]

DISADVANTAGES OF SPLINT

- All splints impede the patient's ability to care for themselves. In a patient with already weakened periodontal support, plaque accumulation near the splinted edges can lead to additional periodontal deterioration
- Caries development is an inherent risk. It necessitates the patient's scrupulous monitoring^[10]
- If not properly made, both fixed and removable splints can cause severe damage.^[11]

PRINCIPLES OF SPLINTING

Splinting's main goal is to reduce tooth movement in three dimensions. The appropriate placement of a cross-arch splint can help with this. Unilateral splints that do not cross the midline, on the other hand, allow the afflicted teeth to rotate faciolingually around a mesiodistal linear axis[Figure 1].^[12]

To be successful with splinting, the compromised teeth's center of rotation must be positioned in the remaining supporting bone, allowing the concerned

teeth to resist tooth movement. Otherwise, if the occlusal or masticatory forces exceed the resistance given by the splinted teeth, the prognosis for any splint is poor.

As a result, the ideal splint should re-direct all occlusal and functional forces down the long axis of teeth, preventing tooth migration and extrusion, and stabilizing periodontally compromised teeth.^[12]

CLASSIFICATION

Major classification is based on the duration of splint usage as:

- Temporary
- Provisional splint
- Permanent splint^[9]

The minor classification depends on whether tooth preparation is required for filling inside or outside the circumference of the tooth as:

- Extracoronal
- Intracoronal.^[10]



Figure 9: Continuous clasp device

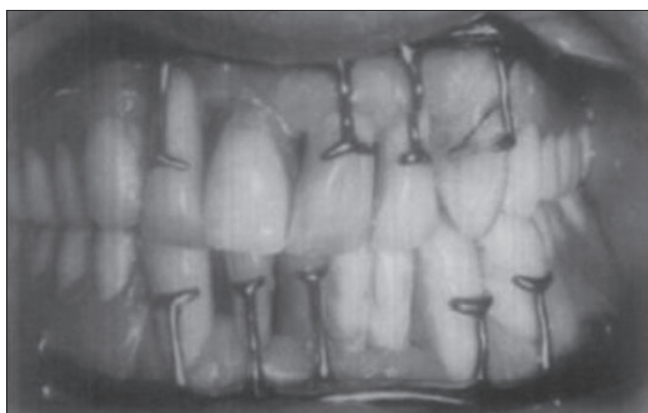


Figure 10: Swing lock partial denture



Figure 11: Fiber splint

ACCORDING TO GOLDMAN AND COHEN

Temporary splints

Extracoronary type

- i. Wire ligation
- ii. Orthodontic bands
- iii. Removable acrylic appliances
- iv. Removable cast appliances
- v. Bonded metal mesh
- vi. Light-cured composite
- vii. Combination of both.

Intracoronary Type

- i. Wire and acrylic
- ii. Wire and amalgam
- iii. Wire and light-cured composite
- iv. Wire, amalgam, and acrylic
- v. Cast chrome cobalt bars with amalgam, acrylic, or both
- vi. Combinations of the above.

Provisional splints

1. All acrylic
2. Adapted metal band and acrylic.

Permanent splints

1. Etched bonded metal retainer
2. Partial coverage fixed prosthesis
3. Full coverage fixed prosthesis.^[13]

GRANT, STERN AND LISTGARTEN CLASSIFICATION

1. Removable (external)
 - a. Continuous clasp devices
 - b. Swing-lock devices
 - c. Over dentures (full or partial).
2. Fixed (internal)
 - a. Full coverage, three-fourths coverage, and inlays
 - b. Posts in root canals
 - c. Horizontal pin splints.
3. Cast metal resin-bonded fixed partial denture
4. Combined
 - a. Partial dentures and splinted abutments
 - b. Removable fixed splints
 - c. Full or partial dentures on splinted roots
 - d. Fixed bridges incorporated in partial dentures seated on posts or copings.
5. Others
 - a. Arch bar splint
 - b. Orthodontic wire and bracket splint.^[14]

TEMPORARY SPLINTS

Temporary splints are those that are worn for less than 6 months during periodontal therapy and may or may not lead to the usage of other splints. It is used in post-acute trauma to lessen unfavorable occlusal stresses for a limited duration, as a supportive strategy in the treatment of advanced periodontal disease, and for orthodontic anchorage. Removable, fixed external, and fixed internal forms of temporary splints are available.^[15]

INDICATION FOR TEMPORARY SPLINTS

- Where there is tooth mobility, such that physiologic rest can be altered



Figure 12: Digital splint

- When there is enough mobility in the teeth that appropriate periodontal treatment and treatments are unable to carry out
- As a diagnostic method for analyzing prognosis before implementing substantial permanent splinting
- To boost the patient's self-esteem.^[16]

EXTRACORONAL TEMPORARY SPLINTS

Cast continuous appliances

As a posterior temporary splint, the cast continuous clasp device has been used, either with retentive clasps or cemented without clasps. This approach has one major flaw: it does not stabilize the teeth against axial or apical displacement. When the splint is not cemented, it provides some resistance to lateral displacement, but not as well as a fixed splint [Figure 2].^[17]

Wire ligature acrylic splint

The application of a wire ligature acrylic splint over the mandibular anterior teeth is especially recommended. Rarely, a wire ligature splint may be recommended solely for use around the posterior teeth [Figure 3].^[18]

The nocturnal protection splint (night guard)

Bruxism is a nocturnal parafunction in which teeth are abraded, reducing their ability to guide and stabilize intercuspation and creating wear facets that aggravate the illness. This splint can act as a protective barrier by bearing the brunt of erosion in place of the teeth, but it must be repaired or replaced when it becomes too thin or frail to be effective as a preventative measure [Figure 4].^[19]

Wire ligature splint

Wire ligatures are routinely used on anterior teeth during periodontal therapy and for a year or two thereafter to help the supporting tissues consolidate. The teeth may have become solid enough to eliminate the need for splinting after this period of ligation. A tooth with an

uncertain or bad prognosis may also be retained with the help of a wire ligature until the treatment's final outcome can be determined. Although the wire ligature is not completely cosmetic, most patients do not mind it because it is constructed of fine wire and is usually hidden below the lips [Figure 5].^[20]

INTRACORONAL TEMPORARY SPLINTS

Wire and acrylic splints

It involves creating a groove on the lingual side of the tooth and employing a stainless-steel wire to stabilize the teeth. A 1.5 mm deep slot was made halfway between the cingulum and the Incisal edge. The resin is then half-filled, and stainless-steel wire is inserted into the slot. After that, the resin is applied over the wire to seal the slot.^[21]

Wire and amalgam splints

Fixed permanent reinforced amalgam splints provide the majority of the potential benefits of fixed gold splints as periodontal prostheses for posterior teeth without the gold restoration's high cost [Figure 6].^[22]

COMBINED AMALGAM, WIRE, AND ACRYLIC SPLINTS

The amalgam-wire-acrylic splint is only used to treat secondary occlusal injuries in periodontally compromised posterior teeth with an unfavorable prognosis. When a more permanent type of cast repair is not possible, this sort of stabilization should be used [Figure 7].^[23]

PROVISIONAL SPLINTS

Provisional splints are used for diagnostic purposes for a period of time ranging from months to years, and they frequently lead to more permanent methods of stabilization. Provisional splinting is defined by Amsterdam M. Fox as a phase of restorative therapy that involves a biomechanical combination of tooth dressing coverages and instantaneous tooth stability. They are employed in circumstances where the periodontal therapy's end outcome cannot be predicted with accuracy during the primary treatment planning.^[15]

Wire band splint

Wire ligation with tension adjustment and orthodontic bands that may be placed on teeth without cutting into enamel or gold crowns are two advantages of the wire band splint.

This device can be used as a provisional splint and implemented for an adequate period of time with periodic caries assessment to see how questionable teeth respond to periodontal treatment [Figure 8].^[24]

PERMANENT SPLINT

Permanent splints are either fixed or removable and are worn indefinitely. They are meant to improve aesthetics and promote functional stability over time.^[15] They are normally only used when periodontal therapy has been completed, and occlusal stability has been achieved.

Continuous clasp devices

- They significantly resemble partial dentures, and their features may be included in partial dentures
- They are removable permanent devices that have continuous clasps and fingers that support loose teeth
- They use the lingual surface to support the teeth and may use the labial surface for additional support or the intracoronal rest [Figure 9].^[14]

Swing lock removable partial denture

When periodontal support is impaired, swing lock removable partial dentures can be used. The swing lock design distributes stress across all remaining teeth and ridges rather than just a few abutment teeth, as is the case with most traditional removable partial denture designs [Figure 10].^[25]

FIXED PERMANENT SPLINT: INTERNAL

Crowns, three-quarter crowns, telescope crowns, inlays, horizontal pin splints, pin ledges, and root canal posts are examples of fixed permanent devices that may include a sequence of soldered castings. The splint is secured in place with cement. If the recession is not severe and the teeth are parallel, full coverage is easy to achieve.^[14]

NEW GENERATION SPLINT

Former composite splints required frequent repair due to fracture composite between teeth, prompting the development of new generation splints. The problem was solved when a high-strength, bondable, biocompatible, esthetic, easily manipulated, colorless ribbon was introduced, and inserted into a resin structure.^[26]

FIBER-REINFORCED SPLINT

Fiber-reinforced composite resins are densely packed composite resins with inserted fiber threads for added strength. Polyethylene yarns woven into a ribbon, glass fibers woven into a ribbon, and short and long strands of glass fibers imbedded in a resin matrix can all be used to make fiber-reinforcement materials (pre-impregnated glass fibers)[Figure 11].^[27] Fiber reinforced composites (FRC) are composite materials made up of three different components: the matrix (continuous phase), the fibers (dispersed phase), and the zone in between (interphase). When compared to other structural

materials, FRC materials have a high stiffness and strength per weight, as well as acceptable toughness.^[28]

TYPES OF FIBER-REINFORCED COMPOSITE SPLINTS

Ribbon splint

Polyethylene fibers are used to make this splint. Ribbon uses a proprietary cross-linked, lock-stitch leno-weave that keeps its shape and does not unravel when cut. The utilization of weaved fiber is based on the material's superior physical qualities. Until polyethylene fibers have been plasma treated, they are chemically incompatible with dental resins. Plasma treatment of the fibers ablates (etches) and chemically activates them, allowing them to chemically connect to dental resins with high interfacial adhesion, resulting in a polymeric hybrid that operates as a laminate. Even under a thin veneer, this hybrid has the qualities required for a load-bearing area. Ribbon bondable reinforcement ribbon was developed as a result of upgraded materials and techniques utilized in the manufacture of industrial polymer composite laminates.^[29]

CONNECT SPLINT

This splint is similarly constructed of polyethylene fibers stitched together. The sort of weave utilized to form the ribbon is the fundamental distinction between the two fiber materials. Connect is a braided weave that unravels and loses its dimensional shape once cut to the length required. As it is inserted in a dental resin, the connect ribbon gets broader or narrower, and the length varies depending on the stresses applied to it.^[29]

DIGITAL SPLINTING

The digitally guided technique offers a therapeutic strategy for splinting periodontally deficient mobile teeth in the mandibular anterior area, effectively maintaining tooth stability, and encouraging bone healing [Figure 12].^[30]

ADVANTAGES

- Plaque control was made easier with this splint's polished titanium alloy surface
- Excellent adaptability to the dental arch's curve and the lingual contour of the teeth
- The clinical workflow is simple, practical, and accurate.^[30]

CONCLUSION

Periodontitis and trauma from occlusion often result in tooth movement. By minimizing trauma, mobility, bone loss, and attachment loss associated with occlusion

can be decreased. Splints can also be used to keep periodontally impaired teeth with a bad prognosis in place for a longer period of time, while more final treatment is scheduled for the patient. Splints are becoming an important aspect of periodontal therapy and maintenance if all factors are examined and proper maintenance therapy is recommended. It should be emphasized, however, that splinting alone will not solve the problem of tooth movement. They are merely a temporary fix for a movable tooth, and movement may return after the splints are removed. Splinting has significant limitations, despite its effectiveness in maintaining the periodontium's health. It is not possible in circumstances when adequate plaque control is not possible. It must be reliable, efficient, and simple to maintain. As a result, in addition to cause-related therapy, splinting is an important adjunct in the treatment of movable teeth.^[31]

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Conflicts of interest

There are no conflicts of interest.

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