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Periodontal splinting: A review before planning a splint

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Abstract

The treatment of periodontitis-associated tooth mobility may involve specific treatment for the different stages of periodontitis starting from simple occlusal therapy, splinting, non surgical phase therapy till surgical phase therapy. The treatment of the periodontitis usually involves nonsurgical and surgical periodontal treatments but sometimes may be limited to only the nonsurgical periodontal treatment. Splinting plays dual role both as primary therapeutic measure as well as adjuvant in stabilizing the teeth for future surgical therapy. Chalifoux-stated that splinting saves a significant number of mobile teeth but requires a high degree of clinical skill and diagnostic expertise. This article discusses the overview of history of periodontal splinting, biomechanics, classifications, objectives, indication, contraindication, principles and various materials used for splinting.

Keywords: Appliances, appliance, splinting, stabilization, tooth mobility

Introduction

Periodontitis is the inflammatory disease of periodontium progressing to destruction of soft & hard tissue in the oral cavity. It is caused by certain bacteria and by local factors progressing from gingivitis to periodontitis and leading to the morbidity and loss of the tooth. Progressive attachment loss around the involved teeth eventually results in increased mobility. Mobility can interfere with function. In certain conditions, it is required to strengthen the supporting tissues reduces mobility and re-establish the function. Nyman and Lang (1994) have distinguished between increased tooth mobility due to compromised bone level which may be stable following treatment like splinting and increasing tooth mobility indicative of an unstable periodontium requiring periodontal management to control inflammation.

Definition

Splint: A splint is any device which joins two or more teeth in order to provide support and to reduce mobility.

According to Glossary of Periodontics Term 1986 a splint is “an appliance designed to stabilize a mobile tooth”.

According to AAP (1996) a splint has been defined “as an apparatus, appliance, or device employed to prevent motion or displacement of fractured or mobile parts”.

The Glossary of Prosthodontic Term defines a splint “as a rigid or flexible device that maintains in position a displaced or movable part; also used to keep in place & protect the injured part”.

Splinting: A splinting is the stabilization of loose teeth by mechanical means with the intention of promoting repair.

Periodontal Splint: A periodontal splint is an appliance used for maintaining or stabilizing or immobilizing mobile teeth in their functional and physiological positions.

Evolution of splinting

Early evidence of human desire to splint weakened teeth can be seen in archaeological findings.

1. A phoenix mandible from 500 B.C. demonstrated, loosened and periodontally compromised anterior teeth bound together by gold wire.
2. Findings from digging of Egyptians show similar gold wiring.
3. The history of splinted dental prosthesis progressed to using silver wire followed later by appliances of gold wire or ribbon to support loose teeth. □
4. Obin & Arvins (1951) advocated the use of self curing internal splint to achieve temporary stabilization.
5. Harrington (1957) modified the splint by incorporating a cemented stainless steel wire.
6. Wellensiek (1958), Shatzkin (1960) & Taatz (1964) presented approaches to the anterior intra-coronal splints.
7. Cross (1954) suggested the use of a continuous amalgam splint for fixation of mobile post teeth.
8. L'yod & Baer (1959) & later on Ward & Weinberg (1961) developed new techniques using a plastic matrix or using wire reinforcement.

In 1993 Alvarez concluded that traumatized tooth to be splinted to avoid constant movement that causes damage for the re-organization of periodontal ligament.

He also stated that situation with

1. Fractured tooth or bone requires splinting for 6-8 weeks
2. With no fracture of tooth or bone may require splinting for 2-3 weeks.

In 2000, Trope *et al.* indicated avulsed tooth requires semi-rigid splint of 7-10 days.

Biomechanics

1. A loose tooth splinted to adjacent firm teeth will be stabilized.
2. When it includes many teeth, adjacent quadrants should be splinted.
3. Teeth tends to loosen bucco-lingually and yet remain firm mesio-distally.
4. "Cross-Arch Stabilization" reduces mobility to the "least common denominator."
5. Splinting should include at least two groups so that they will reciprocally stabilize their "mobility" by their "point of firmness".
6. Teeth are immobilized and occlusal force are distributed over a broader area.
7. The splint may serve as an "orthopedic brace" which permits the retention of loose teeth in useful functions.

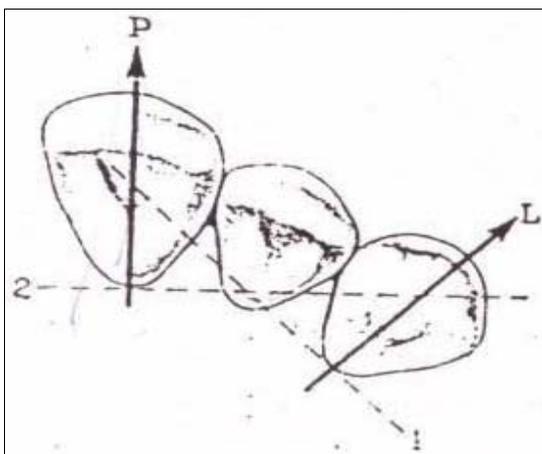


Fig 1: (P) and (L) are labiolingual forces: (1) and (2) indicate axis

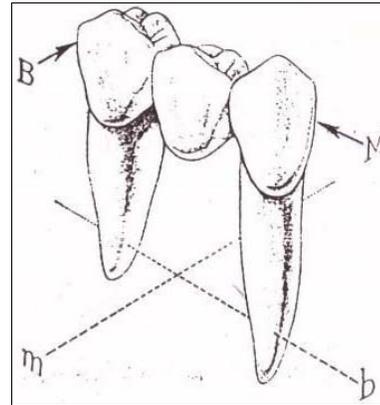


Fig 2: (M) indicates mesiodistal force, dotted line (m) indicates axis between teeth, (B) indicates buccolingual, dotted line (b) indicates an axis which runs through □ both teeth.

Classification

Temporary splint: A splint which exist only for a limited period of time-not a permanent splint.

Provisional splint: A provisional splint can be fabricated for the present situation which can be changed later may or may not to a permanent splint.

Goldman, Cohen & Checker Classification

Temporary splints

(1) Extra-coronal type

- Wire ligation
- Orthodontic bands
- Removable acrylic appliances
- Removable cast appliances
- Ultraviolet-light-polymerizing bonding materials

(2) Intra coronal type

- Wire & acrylic
- Wire & amalgam
- Wire, amalgam & acrylic
- Cast chrome- cobalt alloy bars with acrylic, or both

Provisional splint

- All acrylic
- Adapted metal band and acrylic

Ross, Weisgold and Wright Classification

(1) Temporary stabilization

- Removable extra coronal splints
- Fixed extra coronal splints
- Intra-coronal splints
- Etched metal resin-bonded splints

(2) Provisional stabilization

- Acrylic splints
- Metal-band-and-acrylic splints

(3) Long term stabilization

- Removable splints
- Fixed splints
- Combination removable and fixed splints

Grant, Stem and Listgarten Classification

(1) Removable (external)

- Continuous clasp devices

- Swing-lock devices
- Over dentures (full or partial)

(2) Fixed (internal)

- Full coverage, three-fourths coverage and inlays
- Posts in root canals
- Horizontal pin splints

(3) Cast metal resin bonded fixed partial denture (Maryland splints)

(4) Combined

- Partial dentures and splinted abutments.
- Removable fixed splints
- Full or partial dentures on splinted roots
- Fixed bridges incorporated in partial dentures seated on posts or copings

Others

- Arch bar splint
- Orthodontic wire and bracket splint

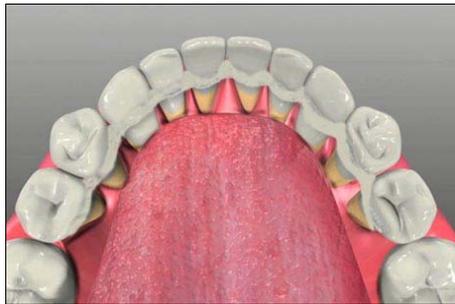


Fig 3: Resin Bonded Splint



Fig 4: Intra-Coronal Splint



Fig 5: Wire & Composite Splint



Fig 6: Etched Metal Splint



Fig 7: Maryland Bridge

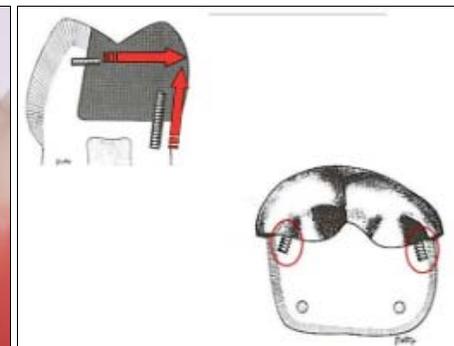


Fig 8: Intracoronary Pins & Posts



Fig 9: Partial Dentures



Fig 10: Swing-Lock Dentures



Fig 11: Soft/Flexible Splint



Fig 12: Composite Splint

Objectives

- To provide rest, reduce mobility, redirection of forces, redistribution of forces and restoration of functional stability.
- To promote healing of underlying periodontal tissues by removing occlusal trauma.
- To promote patient comfort & function.
- Redirection of occlusal forces to all teeth included in the splint. This ensures that forces are within the adaptive capacity of periodontium.
- To preserve the arch integrity splinting restores proximal contacts reducing food impaction at proximal area.
- To promote psychological well being.
- To aid in effective surgical procedure.

Indications

1. To protect mobile teeth and to promote healing.
2. To distribute occlusal forces to the teeth which lost periodontal support and not traumatized.
3. To prevent extrusion of unopposed teeth.
4. To facilitate effective prophylaxis and surgical procedures.
5. To preserve normal masticatory function.
6. To prevent occlusal forces.
7. To stabilize teeth after trauma, subluxation and avulsion.
8. To stabilize teeth after orthodontic movements.

Contraindications

1. Severe tooth mobility.
2. Insufficient number of firm teeth.
3. Patient with very poor oral hygiene.
4. A tooth on which occlusal trauma has been reduced.
5. Teeth with severe inflammation and pathology.

Advantages

- Alveolus remodeling of alveolar bone and periodontal ligament for orthodontically moved tooth or teeth.
- Provides healing of supporting structures.
- Fine stability and comfort for patient will be provided.
- Facilitates surgical procedures by keeping the tooth immobile.
- Distributes occlusal forces on a wide area.

Disadvantages

- Accumulation of plaque can lead to further periodontal maintenance.
- Requires excellent OHI maintenance.
- If one tooth in the splint is in traumatic occlusion, it can injure the periodontium of all other teeth included in the splint.
- Development of caries is an amenable risk.

Principles of splinting

- Inclusion of sufficient area of healthy teeth. Healthy teeth included in the splint should have double the area of root surface than the mobile teeth to be splinted.
- If one tooth included in the splint is in a traumatic occlusion, the periodontal tissue of the remaining teeth may also be injured. So coronoplasty to be performed in most of the cases.
- It should be fabricated in such a way as to facilitate proper plaque control.
- Should not interfere with occlusion.
- Esthetically acceptable.
- To avoid forces from lip, cheek and tongue.

Material used for splinting

1. Ligature wire -Stainless steel wire, brass wire
2. Night guards-Heat polymerized poly-methyl methacrylate
3. Welded stainless steel band splints
4. Castable splints-stainless steel or gold or acrylic
5. Amalgam splint
6. Pin & screw continuous clasp splint
7. Monofilament nylon composite splint
8. Wire composite splint
9. composite or fiber reinforced composite as internal splint
 - a) Reinforced with metal wires
 - b) Glass reinforced fibers or pin. (Brazilay,2000) (not recommended)

Discussion

Splinting of the teeth will not prevent or retard apical down-growth of plaque and associated attachment loss. In fact splint act as a challenge for OHI compared to the same thing for that patient.

It was also observed that the areas of root bifurcation and trifurcation are more susceptible to excess occlusal forces.

In a study to determine the effect of initial preparation and occlusal adjustment on tooth mobility, it was observed that for teeth with initial mobility of greater than 0.2 mm there was a decrease in tooth mobility up to 20%.

Splinting of mobile teeth doesn't have any effect on mobility reduction after initial therapy.

The effect of rigid splinting on anterior teeth following extrusion of teeth by 3 mm and their replacement back into the socket, the investigators did not observe any significant difference between the splinted and non-splinted teeth in terms of periodontal ligament width or stress or strain values. Results of the study showed that rigid splinting of luxated teeth did not improve the mechanical properties of the periodontal ligament during healing.

The use of a metal primer on stainless steel wires either separately or in combination with sandblasting had lower

wire-composite interface bond strength than sandblasting alone, while no surface treatment on the wire had the least bond strength for both the light and chemically activated composite resins.

Dental splinting is frequently needed following traumatic injuries to stabilize subluxated, luxated, avulsed and root-fractured teeth. The prognosis is determined by the type of injury rather than factors associated with splinting. Duration of splinting is not recommended to be more than 10 days.

Significantly less tooth mobility with direct composite splint compared to all other splints and no differences between nylon-composite and wire composite splints were observed. The nylon and SS or NT wires up to 0.016" (0.4 mm) diameter are significantly more flexible than direct composite splints and thus may be better suited for the splinting and management of traumatized teeth.

According to Lindae, when progressive bone loss with normal width of periodontal ligament is noticed, two of one sequalae can happen, either tooth mobility that does not interfere with patient's comfort or tooth mobility that interferes with patient's comfort.

In condition with tooth mobility that interferes for regular functions, splinting is required to reduce or fix the mobility. Under these conditions, a provisional splint followed by a fixed splint is advisable for long term results of the periodontally compromised mobile teeth.

The provisional splint may be unilateral or bilateral depending on the number of mobile teeth involved. The time period requires 6 months for monitoring abutment teeth.

Conclusion

In advanced periodontal disease, tissue destruction reaches the level of extraction of one or more teeth. In such conditions, remaining teeth available for Periodontal treatment can be immobilized that fulfils the major objective of stabilizing hypermobile teeth as well as replacing the missing teeth amidst mobile teeth.

The choice of splint varies widely from simple composite splint to removable cast partial prosthesis. Later on review when no increase in mobility of the previously assigned provisional bridge or abutment teeth is noticed, the permanent splint such as metal bridge or PFM bridge may be included. The time period for retaining the periodontal splinting may vary from other types of traumatic splinting or orthodontic splinting. Thus the choice of splint, time period for splinting and material of splinting requires the collective knowledge about the biomechanics of splinting related to the patient's existing periodontal condition.

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