

Splinting and Stabilization in Periodontal Disease

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Abstract: *The mobility of teeth is a common complaint of patients with fairly advanced periodontal disease. It is mainly caused by a loss of supporting bone. Dental Splint is an appliance designed to immobilize and stabilize mobile loose teeth. The purpose of this article is to review the method to treat mobility of teeth by splinting, its rationale, indications, methods and biomechanics.*

Keywords: Splinting, Stabilization, Periodontal disease

1. Introduction

The finding in an Egyptian tomb of two teeth ligated by a gold wire is evidence that the treatment of periodontal disease and an attempt to save loose teeth has occupied the attention of those endeavoring to treat the oral cavity since the dawn of recorded history(1). Increased tooth mobility has concerned dentist since 19th century (2). Periodontal disease impairs tooth support and permits secondary trauma to occur. As a consequence, teeth may loosen, and the alveolar bone may be subjected to additional damage. Thus the reduction of mobility is an important objective of periodontal therapy.

Tooth Mobility

Tooth mobility is defined as a visually perceptible movement of the tooth away from its normal position when a light force is applied. (Gher 1996)

Tooth Mobility as an Indicator of the Functional Status of the Periodontium

Physiologic or normal tooth mobility refers to the limited tooth movement or tooth displacement, that is allowed by the resilience of an intact and healthy periodontium, when a moderate force is applied to the crown of the tooth examined {Muhlemann 1951 a, 1954, Korber 1971. Lindhe & Nyman 1989}.

Physiologic or normal tooth mobility depends basically on

- (i) The quality (Mthlemaon 1960) or "viscoelastic" properties (Wills et al. 1972) of the periodontal tissue
- (ii) The anatomical characteristics such as the amount of supporting alveolar bone and the width of the periodontal ligament space (Lindhe & Nyman 1989, Schulte et al. 1992).
- (iii) Other factors such as number, shape and length of the roots (Ljndhe & Nyman 1989) or the intrinsic elasticity of the tooth itself (Korber 1962) may also be considered.

Altered/Pathologic Tooth Mobility

A decrease in supporting structures of teeth or an increase in the magnitude, direction, duration and frequency of forces or a combination of both may result in tooth mobility(3). An alteration of the mobility characteristics of a tooth can represent a transient or a permanent change in the periodontal tissues: An increased mobility may be associated with different physiologic or pathologic phenomenon, while a decreased mobility usually is the result of therapy.

Increased Tooth Mobility:

Physiologic phenomenon associated with increased tooth mobility include, e.g.,

- a) Tooth eruption, due to the incomplete maturation of the periodontal membrane during the process (Muhlemann] 954,1960) and
- b) Pregnancy, as a result of the hormonal influences on collagen and vascular structures of the ligament tissues (Muhlemann 1960, Mtihiemann et al. 1965, Rateitschak 1967).

The greatest tooth mobility is observed upon arising, and decreases during the day(4)

2. Pathologic Phenomenon

Trauma from Occlusion

Among the pathologic conditions related to hypermobility, trauma from occlusion has been widely investigated (Ramfjord & Ash 1981, Lindhe & Nyman 1989). In the case of a traumatic occlusion, "passive" and "functional" mobility, wear facets and enlargement of the periodontal ligament space have been reported as the common features (Lindhe & Nymao 1989, Jm & Cao 1992). The increased tooth mobility recorded at an overloaded tooth often includes a phase of progressive ("developing") and a phase of stabilised ("permanent") tooth hypermobility (Lindhe et al. 1989).

Histologic findings in the "developing mobility" phase of tooth hypermobility were

- 1) Enlargement of the periodontal ligament space,
- 2) Osteoclastic alveolar bone resorption,
- 3) Vascular alterations and degenerative phenomena in the periodontal membrane and reduced number of collagen fibers inserting in the root cementum, in the alveolar bone proper and in the crest (Biancu et al. 1995).

Primary and Secondary Traumatism

Physical forces are exerted on the periodontium, superimposing their influence on whatever local and intrinsic factors are present. Habits, dental appliances, dental procedures, and traumatic impact may produce such forces. Stresses are also applied during mastication, swallowing, bruxism, and clenching. During mastication teeth and there

supporting structures are generally subjected to severe occlusal forces, upto 50 Kgs.(5)

Primary traumatism is the production of mobility in a tooth with normal support subjected to a force in excess of physiologic limits.

Secondary traumatism is the production of mobility by normal forces in a tooth with weakened support. When local and intrinsic factors such as inflammation and metabolic disturbance are present, normal forces may produce mobility in a tooth with a full osseous support.

Prognosis of Periodontally Involved Teeth:

The prognosis of periodontally involved teeth depends often on the initial mobility and whether it can be altered by treatment. The measurement of mobility is essential in determining the therapy required and in evaluating the results of such treatment.

Degree of Movement:

The degree of movement is indicated on an arbitrary scale of 0 to 3 given by **MILLER 1950**(6)

A reading of 0 indicates no perceptible movement;

Score 1- mobility greater than normal

Score 2- mobility of up to 1 mm in a buccolingual direction.

Score 3- movement of more than 1mm in a buccolingual direction combined with the ability to depress the tooth.

Glickmans Index (1972)

- 0- Normal mobility
- Grade I- Slightly more than normal
- Grade II- Moderately more than normal
- Grade III- Severe mobility faciolingually and / or mesiodistally combined with vertical displacement.

Lindhe (1997)

- Degree 1: movability of the crown 0.2- 1mm in horizontal direction.
- Degree 2: Movability of the crown of the tooth exceeding 1 mm in horizontal direction.
- Degree 3: Movability of the crown of the tooth in vertical direction as well.

The opportunity to make objective measurements of tooth mobility and of force applied to the tooth will ultimately permit a better clinical evaluation of the factors that affect mobility. This is important since mobility is a basic symptom of periodontal disease.

Thus the reduction of mobility is an important objective of periodontal therapy. Root planing, curettage, oral hygiene, and surgery may cause teeth to tighten as inflammation is resolved. However, a transient increase in mobility may occur immediately after surgery. Occlusal adjustment, periodontal orthodontics, and restorative dentistry may alter occlusal relationships and redirect forces, thereby reducing traumatism. This may result in the teeth becoming firmer, Increasing the support of loose teeth may also increase their firmness; the device used for such treatment is the splint.

SPLINT

Any apparatus or device employed to prevent motion or displacement of fractured or movable parts. (Hallmen et al 1996)

An appliance for immobilization or stabilization of injured or diseased parts. (Glickman 1972)

Dental Splint: An appliance designed to immobilize and stabilize mobile loose teeth. (AAP1986 Glossary)

Classification:

I) RAMFJORD'S CLASSIFICATION (1979)

• Temporary:

- a. Fixed- Fixed external type (2-6 months)eg. Ligature wire, orthodontic bands.
- b. Removable-RPD, Night guards, removable acrylic splints

- **Provisional:** 8-12 months diagnostic used in borderline cases where the outcome of treatment cannot be predicted. eg. Temporary external splints.

• Permanent:

- a) Fixed- Full crowns, pin ledge type of abutment retainers.
- b) Semirigid-
- c) C. Removable- Telescopic crowns, clasp supported partial denture.

• Grant, Stern and Listgarten(1988)

I) Temporary:

Extracoronary (External)-Ligature splint, Enamel bonding material, welded bond splints, continuous splints, night guards

Intracoronary (Internal)- Acrylic splints, Composite splints, acrylic full crowns

II) Provisional Splints

Serves to stabilize a permanently mobile dentition from the time of initial tooth preparation until the time the dentition is periodontally healthy enough for permanent restorations.

III) Permanent Splints may be classified as follows:

1. Removable—external

- a) Continuous clasp devices
- b) Swing-lock devices
- c) Overdenture (full or partial)

2. Fixed—internal

- a) Full coverage, three-fourths coverage crowns and inlays
- b) Posts in root canals
- c) Horizontal pin splints

3. Cast-metal resin-bonded fixed partial dentures (Maryland splints)

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. Endodontic

3. Rationale for Splinting

- 1) **Rest:** As for many injured or diseased parts of the body, immobilization, permits undisturbed healing. Active periodontitis, alone or combined with parafunctional activity, can be complicated by intrinsic or extrinsic factors, such as strategically missing teeth, malocclusion and short roots. Occlusal rest provided by splint therapy of one form or another helps to eliminate or at least to neutralize some of the adverse occlusal factors that compound the effects of already existing periodontitis.
- 2) **Redistribution Of Forces:** The stabilization of weekend teeth by splinting increases resistance to applied force. Reciprocal antagonisms that increases the effective root area are provided. The redistribution of forces ensures that excessive force on a single tooth does not exceed the adaptive capacity of the surrounding tissue and that jiggling movements, which can contribute to further bone loss in an existing periodontitis are prevented.
- 3) **Redirection Of Forces :** Splinting effects a redirection of force in a more axial direction over all the included in a splint.
- 4) **Preservation Of arch Integrity:** Splinting restores, proximal contacts that have been disrupted by missing and migrated teeth, makes the patient more comfortable, and reduces the likelihood of food impaction and consequent break down.
- 5) **Restoration of arch stability:** splinting restores proximal contacts, that have been disrupted by missing and migrated teeth, that makes the patient more comfortable, and reduces the likelihood of food impaction and consequent break down.
- 6) **Psychologic well being:** Hypermobility can become so severe that patients become fearful of losing teeth. Stabilization by splinting and restoration not only improves function, but it also can restore a sense of a well being.

Indications (AAP)

- 1) Stabilize moderate to advance tooth mobility that cannot be treated by other means.
- 2) Stabilize teeth when increased tooth mobility interferes with normal masticatory function and comfort of the patient.
- 3) Stabilize teeth in secondary occlusal trauma.
- 4) Prevent tipping or drifting of the teeth.
- 5) Prevent extrusion of unopposed teeth.
- 6) Facilitate splinting
- 7) Stabilization of mobile teeth during surgical especially regenerative therapy. (Serio 1999).
- 8) Stabilize teeth following acute trauma.
- 9) Stabilize teeth following orthodontic movement.
- 10) Ascertain whether occlusal therapy will be effective or not.

Theoretical Aims

The theoretical aims of splinting are as follows:

- 1) Rest is created for the supporting tissues, permitting repair of trauma.
- 2) Mobility is reduced immediately and, it is hoped, permanently." In particular, jiggling movements are reduced or eliminated.
- 3) Forces received by any one tooth are distributed to a number of teeth.
- 4) Proximal contacts are stabilized, and food impaction (but not retention) is prevented.
- 5) Migration and overeruption are prevented.
- 6) Masticatory function may be improved.
- 7) Discomfort and pain are eliminated,
- 8) Appearance may be improved.

Ideal properties of splint. It should be:

- (1) simple, (2) economic, (3) stable and efficient, (4) hygienic, (5) nonirritating, (6) not interfere with treatment, (7) esthetically acceptable, and (8) not provoke iatrogenic disease.

Contraindications

- 1) When there is moderate to severe increased tooth mobility in the presence of periodontal inflammation or primary trauma
- 2) Prior occlusal adjustment has not been done on teeth with occlusal interferences and prior occlusal trauma.
- 3) There is an insufficient number of non mobile teeth to adequately stabilize the mobile teeth.
- 4) Inadequate oral hygiene.

The presence of splints, often makes it difficult for the patient to achieve adequate plaque control and thus may predispose to further periodontal destruction.(7)

4. Biomechanics of Splinting

Theoretically, a splint limits the amount of force a single tooth can receive during occlusal loading. It does this by distributing occlusal forces over a large number of teeth. Splinting also alters the direction of applied forces. A mobile individual tooth is capable of being loaded and moved in several directions: mesio-distally, buccolingually and apically When the mobile tooth is splinted, the splint tends to redirect lateral forces into more vertical forces, which the tooth is better able to resist. In an individual tooth, the mesially directed force produces a center of rotation in the apical third of its root. The same force directed to the same individual tooth in a four unit, fixed splint produces a center of rotation in the root of the first molar. This produces a wider fulcrum about which the splint can rotate, thereby redirecting the mesial force into a more vertical one.

5. Conclusion

The mobility of teeth is a common complaint of patients with fairly advanced periodontal disease. It is caused by a loss of supporting bone caused due to periodontal disease. Dental Splint is an appliance designed to immobilize and stabilize mobile loose teeth. Various methods of splinting

should be applied depending upon prognosis of mobile teeth and periodontal conditions of surrounding teeth.

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