CHAPTER 11. SPLINTING

DEFINITIONS

Splint: Any apparatus, appliance, or device employed to prevent motion or displacement of fractured or movable parts.

Dental Splint: An appliance designed to immobilize and stabilize loose teeth.

Occlusal Trauma: An injury to the attachment apparatus as a result of excessive occlusal force.

Primary O.T.: Injury resulting from excessive occlusal forces applied to a tooth or teeth with normal support.

Secondary O.T.: Injury resulting from normal occlusal forces applied to a tooth or teeth with inadequate support.

Occlusal Traumatism: Injury to the periodontium resulting from occlusal forces in excess of the reparative capacity of the attachment apparatus.

Traumatogenic: Capable of producing a wound or injury.

RATIONALE AND CLASSIFICATION

Lemmerman (1976) reviewed the rationale for splinting and defined a splint as an appliance for immobilization or stabilization of injured or diseased parts. Splints were classified as temporary, provisional, or permanent on the basis of duration and purpose. Temporary splints are those which are used less than 6 months during periodontal treatment and may or may not lead to other types of splinting. Provisional splints may be used from several months to years for diagnostic purposes, and usually lead to more permanent types of stabilization. Permanent splints are worn indefinitely and may be either removable or fixed. Lemmerman also described the concept of reversible and irreversible mobility. Reversible mobility is found in a relatively normal periodontium that is capable of recovery following therapy. Irreversible mobility is observed in a reduced periodontium. This type of mobility may be reduced, but cannot be eliminated. The rationale for splinting is based primarily upon the intended purpose. Other considerations include whether or not the periodontium is healthy or diseased and whether there is a need to prevent mobility or drifting. The author suggests that the rationale for splinting might include cases of post-acute trauma, prevention of drifting in normal dentitions during occlusal therapy, or to provide functional comfort by preventing mobility in diseased dentitions.

Ferencz (1991) reviewed splinting and noted that there is little rationale for splinting teeth manifesting primary occlusal trauma. Splinting during or after periodontal treatment is often useful in controlling the effects of secondary occlusal trauma and in instances where decreased mobility may improve comfort and function. Mobility may inhibit periodontal repair during therapy and therefore provides an additional rationale for splinting. The author further classified splints as short-term, provisional, and long-term. Short-term splints can be extracoronal (fixed or removable) or intracoronal (composite, wire with composite or amalgam). Provisional splints are designed to protect and stabilize teeth during therapy when definitive splinting with fixed restorations is planned later. Long-term splints may be fixed, removable, or a combination of both. According to the author, fixed splinting will provide the most effective means of long-term support.

Lindhe and Nyman (1977) presented an extensive review of the etiology and rationale for treatment of periodontal disease with a discussion of occlusal adjustment. The authors' main objectives for occlusal adjustment and splinting were control of progressive mobility and re-establishment of a narrow periodontal ligament space. They also felt that the presurgical phase of therapy may be useful in differentiating between occlusal trauma and infrabony pockets due to periodontal disease.

METHODS OF SPLINTING

Pollack and Ponte (1981) described methods of non-crown and bridge splinting, including specific techniques for non-precious metal splinting. These included an extracoronal acid-etch technique, pin composite splints, and pin amalgam splints. The extracoronal acid-etch technique uses 16-gauge stainless steel wire. The pin composite splints utilize TMS minim pins placed in the gingival floors of adjacent Class III preparations. The pins are bent across the contact areas and composite is placed and finished around the pins. The pin amalgam splint is similar to the composite technique, with TMS minim pins bent across the contact areas of two adjacent Class II amalgam preparations. Tofflemier retainers with interproximal cut-outs are placed around the teeth and amalgam is placed and carved, leaving the coronal aspects of the restoration bridging the contact area.

Chalifoux (1991) discussed splinting of anterior teeth using composite bonding, intracoronal wire, extracoronal mesh, metal bonding, and crown and bridge techniques. Composite bonding techniques use micro- or macrofilled composite with a standard acid-etch technique to bond contact points. It is indicated for slightly mobile teeth with few restorations, but has low overall strength. The intracoronal wire technique resembles the composite technique. A groove is prepared across the lingual tooth surfaces and 22-to 28-gauge wire is adapted into the groove and held into position with composite. This splint is used most often for maxillary teeth with moderate mobility and small restorations. With the extracoronal mesh technique, wire mesh is adapted to the teeth and is bonded using composite. This splint is useful in areas with moderate mobility and provides moderate strength without being invasive tooth preparation. In the metal bonding technique, an acid-etched metal framework is constructed in the laboratory and bonded to the teeth. It is used in areas with moderate mobility and small restorations. Problems with this technique arise when 1 or 2 teeth become unbonded, compromising the splint. Fixed partial denture prostheses may be used for very mobile teeth, teeth with large restorations, or both.

Saravanamuttu (1990) described a non-rigid, intracoronal splint for periodontally involved teeth that have received orthodontic treatment. In this instance it was considered desirable for the teeth to have a degree of functional loading for the reformation of a healthy periodontium. The technique involved preparing a groove on the lingual surfaces of the teeth and adapting an annealed, multi-strand (flexible) orthodontic wire. The wire was secured to the teeth with composite, ensuring that the interproximal areas remained unbonded.

Gerstein and King (1975) reviewed the use of removable partial denture splints for the treatment of mobility. The appliance referenced was designed by Kratochvil and used specific design criteria to promote maximum stability and cleansability. Occlusal rests should extend completely through the center of the occlusal surface in a mesio-distal direction at a depth of 1.5 mm. Interproximal guide planes provide bracing and help eliminate tooth-prosthesis voids. Major connectors should be kept as far away from gingival margins as anatomically possible. Minor connectors should be strong and cleansable. The "I" bar clasp is recommended because it engages a more physiologic degree of undercut, is a cleaner clasp arrangement, and places less unfavorable forces on the abutment when torquing forces are produced by the partial denture. Removable splints were promoted due to better access for plaque removal when compared to fixed splints. Other advantages of the removable splints include less tooth preparation, pulpal trauma, chairside time, clinical effort, and expense.

Rudd and O'Leary (1966) determined that a specially-designed removable partial denture using multiple parallel guiding planes and bracing clasps with a rigid major connector could be used as a removable splint to stabilize periodontally weakened teeth. Such partial dentures require extremely meticulous preparation and technical expertise for "precision" design. Prior to periodontal therapy, the mean mobility of the 219 teeth tested was 0.0115 mm. This mobility was reduced to 0.0104 mm after periodontal therapy and further reduced to 0.0096 mm after 1 to 3 months of removable splint insertion. Although the time periods for the study were short, the authors concluded that precision designed partial dentures may be effective in stabilizing mobile teeth.

EFFECTS OF SPLINTING

Using five Rhesus monkeys, Glickman et al. (1961) studied the effects of splinting teeth in hyperocclusion. The authors observed that forces applied to 1 tooth in a splint were transmitted to all teeth within the splint. The direction of the initial force was maintained and comparable areas of the splinted periodontium were affected. The bifurcation and trifurcation areas were most susceptible to excessive force. Forces applied to non-splinted teeth were not transmitted to adjacent teeth and force sufficient to cause necrosis did not cause pocketing.

Mandel and Viidik (1989) used Vervet monkeys to study the effects of rigidly splinting anterior teeth that had been extruded 3 mm and replaced into the socket. Two weeks after post-extrusive healing, no significant differences were found between splinted and non-splinted teeth in terms of periodontal ligament (PDL) width or stress and strain values of the PDL. Within 2 weeks, the injured PDLs had regained 50 to 60% of the shear and strain values noted in non-injured teeth. Rigid splinting of the luxated teeth did not improve the mechanical properties of the PDL during healing.

Rateitschak (1963) studied the effect of initial preparation and occlusal adjustment on tooth mobility in 80 patients using the Muhlemann periodontometer with a deflective force of 500 gm. The author observed that if the initial mobility was greater than 0.2 mm, initial preparation and occlusal adjustment decreased tooth mobility up to 20%. Orthodontics or removable splints caused an initial increase in the mobility which returned to baseline by 2 years.

Nyman et al. (1975) studied 20 patients who had originally exhibited severe periodontal breakdown and extensive tooth loss. Extensive fixed bridgework was placed following periodontal therapy and the patients monitored for 2 to 6 years. No further bone loss was observed between the insertion of the fixed bridgework and the final examination. The authors reported no increase in PDL width of the abutments or changes in mobility.

Renggli et al. (1984) studied the use of telescoping bridges placed 3 to 4 months after surgical therapy that could be removed by the patient on a daily basis for access to hygiene. The authors noted that the telescoping bridges reduced mobility during an initial 4-week period when they were not removed and for an additional 6 weeks, when the bridges were removed daily. The mobility of non-splinted control teeth was also reduced at the 4- and 10-week periods. The reductions in mobility were not significantly different among the 2 groups. The authors suggest that the reductions in mobility may have been due to the establishment of a harmonious occlusion and not necessarily due to splinting.

Kegel et al. (1979) studied posterior tooth mobility following scaling and root planing, occlusal adjustment, and oral hygiene education in splinted and unsplinted teeth utilizing 7 patients in a split-mouth design. The splints were removed at measurement times and then replaced during the experimental study which lasted 17 weeks. The authors found no significant difference between splinted and non-splinted segments with regard to tooth mobility, gingival bleeding, attachment level, or radiographic bone scores. Teeth that were initially more mobile received no significant benefit from splinting when compared to initially less-mobile teeth.

Galler et al. (1979) used a similar design to study the effects of splinting upon mobility during osseous surgery. Using maxillary teeth in a group of 10 patients, 1 quadrant was splinted following osseous surgery and the other was not. During a follow-up period of 24 weeks, it was noted that splinting had no effect on mobility at any time. An overall average of 0.6 mm of bone was removed per tooth with osseous resection and no significant correlations existed between the amount of bone removed and the change in tooth mobility for either pooled splinted or unsplinted teeth. Also, postoperative mobility seemed more dependent upon preoperative mobility than on the treatment method. Splinting had no effect on attachment level or alveolar bone height.

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