

Tooth Stabilization Improves Periodontal Prognosis: A Case Report



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As patients are keeping their teeth throughout their lifetimes due to advances in periodontal treatment, the progression of periodontal disease does continue. For patients with moderate to severe chronic periodontitis, the development of tooth mobility can be a significant factor compromising treatment prognosis. Mobility may be caused by inflammation of the periodontium, loss of periodontal attachment, or functional or parafunctional forces on teeth.¹ Splinting of teeth is considered to an important component of occlusal treatment when tooth mobility is present.

This article discusses how stabilization of mobile periodontally involved teeth can improve the long-term prognosis. A clinical case is presented to demonstrate the treatment outcome that can be achieved with a stabilization technique.

TOOTH STABILIZATION

A splint has been defined as an apparatus, appliance, or device employed to prevent movement or displacement of fractured or movable parts.² In dentistry, splinting or tooth stabilization usually refers to joining teeth together either unilaterally or bilaterally, to transmit increased stability to the entire restoration. Typically, a splint is indicated due to a single tooth or multiple teeth having mobility. Spear³ presented 4 goals of occlusal treatment: (1) to control the amount of loading that occurs at the temporomandibular joint; (2) to control the load that the tooth receives so that the periodontium is not overstressed; (3) to control the load placed on the occluding surfaces of the teeth; and (4) to produce an occlusal relationship with no pathological symptoms for the muscles of mastication.

When mobile teeth are present, tooth stabilization with splinting can be a factor for successful occlusal treatment.

Tarnow and Fletcher⁴ described the indications and contraindications for splinting periodontally involved teeth. They stated that the rationale to splint teeth should be based upon the degree of periodontal compromise of the dentition, based upon the amount of radiographic bone loss and/or measured tooth mobility. The primary reasons to control tooth mobility with periodontal splinting are: (1) primary occlusal trauma; (2) secondary occlusal trauma; and (3) progressive mobility, migration, and pain on function.

Primary occlusal trauma is defined as injury resulting from *excessive* occlusal forces

applied to a tooth or teeth with *normal* periodontal support. Secondary occlusal trauma is injury resulting from *normal* occlusal forces applied to a tooth or teeth with *inadequate* periodontal support. Tooth mobility has been shown to contribute to decreased masticatory and occlusal function, as well as patient discomfort when eating.

Identification of progressive mobility requires repeated clinical observations over a period of weeks to months.

In the past, the use of splinting of periodontally compromised teeth was contentious. The presumption was that the use of splinting to control tooth mobility was required to control gingivitis, periodontitis, and pocket formation. It was assumed that mobility had a direct relationship to attachment loss and vertical osseous defect formation. Another assumption was that increasing tooth mobility was a direct consequence of traumatic occlusion, bruxism, and clenching. Consensus also pointed to the fact that even normal physiologic function



Figure 2. Clinical appearance of maxillary anterior teeth after scaling and root planning: (a) facial view and (b) lingual view.

including mastication and swallowing contributed to tooth mobility.⁵

A number of periodontal clinical studies investigated these assumptions. When teeth were occlusally overloaded and other variables that contribute to periodontal disease were controlled, it was difficult to produce gingivitis, periodontitis, and pocket formation.^{6,7} Another study reported no correlation between splinting and reduced tooth mobility during initial periodontal therapy.⁸ Control of tooth mobility with splinting after osseous surgery did not reduce mobility of the

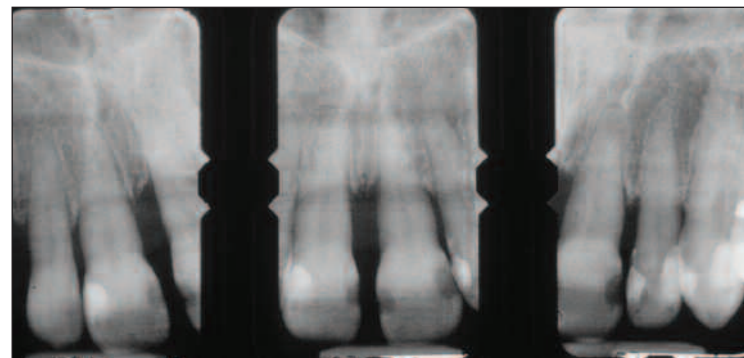


Figure 1. Radiographic view of maxillary dentition demonstrating 60% bone loss.

individual teeth.⁹ Tooth mobility, however, can be controlled and managed with splinting therapy.¹⁰⁻¹² The evidence demonstrates support for the tooth stabilization via splinting to improve the periodontal prognosis.^{1,11-17} Once teeth are splinted the splint must be maintained, and the patient and clinician must be committed to recalls on a regular basis for periodontal maintenance. Splinting of teeth is a long-term commitment by clinician and patient.

Occlusion has been associated with periodontal health.¹⁸ Glickman¹⁹ postulated a model referring to the role of controlling abnormal occlusal forces in obtaining improve-



ments in gingivitis and periodontitis that cause gingival inflammation. His concept described that trauma from occlusion had the potential to result in infrabony pockets and vertical osseous defects. Waerhaug, et al^{20,21} reviewed a similar hypothesis and concluded that there was little evidence to validate a relationship between trauma from occlusion and severity of periodontal tissue breakdown. Occlusal trauma and mobility in the periodontally compromised dentition can contribute to a deteriorating periodontal prognosis.^{1,13,14,18}

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In clinical studies with teeth occlusally overloaded, while other variables that contribute to plaque-induced periodontal disease were controlled, it was difficult to produce gingivitis, periodontitis, or pocket formation.^{6,7} Studies investigating posterior tooth mobility established that during and after periodontal initial therapy there was no significant difference in the mobility of nonsplinted teeth and splinted teeth (after removal of the splint).^{8-10,22} Increased tooth mobility is detected clinically and described in terms of amplitude of displacement of the clinical crown. Again, it must be reiterated that the cause of detected tooth mobility should be further clarified—whether by reduced height of supporting tissues as a result of plaque-induced periodontal disease, or by trauma from occlusion, or a combination thereof. Tooth mobility is reported during periodontal charting, often using the Miller Index.²³ Degree 0 mobility is considered “physiologic,” whereby the tooth is mobile within the alveolus at approximately 0.1 to 0.2 mm in a horizontal direction. The Miller index defines a degree 1 mobility as a tooth that moves approximately 0.5 to 1.0 mm. A degree 2 mobility will exceed 1 mm in a horizontal direction. A degree 3 classification refers to a tooth that not only has a facial-lingual component but also is depressible.

There is no doubt that splinting does reduce tooth mobility while the splint is in place.^{1,10,11,24-26} Currently, it is generally accepted that tooth mobility is an important clinical parameter in predicting periodontal prognosis of those teeth.²⁷ The main reasons to stabilize the periodontally compromised dentition with splinting include: decreasing patient discomfort, increasing occlusal and masticatory function, and improving the periodontal prognosis of mobile teeth.²⁸ Further, regenerative procedures using membranes and bone graft have greater predictability if tooth movement is eliminated.^{29,30}

Over the years there have been many different restorative techniques used for splinting teeth. Before adhesive restorative dentistry had been introduced the optimal choice for splinting teeth was the use of full coverage cast restorations. Each tooth to be splinted had a crown placed and all the crowns were joined together.^{11,31}



Figure 3. Facial preparation of the maxillary anterior teeth



Figure 4. Placement of the Ribbond fiber reinforcement ribbon: (a) facial view and (b) lingual view.



Figure 5. Completed restoration with the fiber reinforced splint and direct composite resin veneering: (a) facial view, (b) lingual view, and (c) radiographic view.

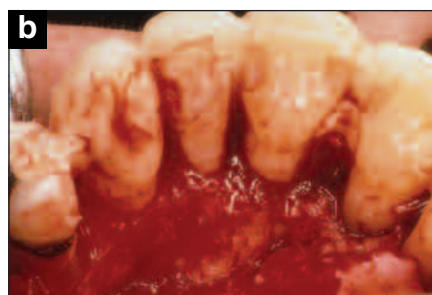


Figure 6. Surgical treatment with an apically positioned flap with osseous contouring: (a) facial view and (b) lingual view.



Figure 7. Gingival tissues sutured with a modified vertical mattress suture: (a) facial view and (b) lingual view.

The advantage of this technique was that the teeth could be stabilized with an acrylic resin provisional restoration during periodontal treatment. At the completion of active therapy the definitive cast restoration was fabricated and completed. Over the relatively short period of time of treatment for some teeth the prognosis was difficult to define and could lead to premature replacement of the porcelain-metal fixed-partial denture splint as teeth were lost. A more conservative approach had been reported using a cast gold restoration for the lingual surfaces of the mobile teeth, with the used of pin retention placed in the tooth preparations and cast into the metal framework.³²

The clinical success of adhesive bonded composite resin to etched enamel led to case reports and techniques using a variety of materials. One modification of the cast metal lingual splint was use of a resin bond-

ed adhesive technique to retain the splint.^{33,34} Direct placement, single visit splints have been described. Clinical techniques using wires twisted around teeth and covered with resins,¹² metal and nylon mesh embedded into resins,³⁵ and for posterior teeth the use of channels prepared into the occlusal and proximal surfaces of teeth or into existing amalgam restorations with either cast bars or thick wires placed in the channels and covered with resins have been reported.^{36,37} Clinical failures of these materials were common because of loading stresses placed on the splint during normal and parafunction.^{12,38} Repairs of these splints usually led to overcontoured and overbulked restorations. These overcontoured restorations led to hygienic difficulties and food and plaque retention.^{14,25}

Composite resins by their chemical nature are brittle materials. In function when supporting pontics or

stabilizing mobile teeth, cracks within the connector areas can lead to outright fracture.³⁹⁻⁴² The introduction of bondable reinforcement ribbons and fibers, when embedded into composite resins, created a laminated structure with improved physical properties and a greater resistance to fracture. Research with fiber reinforced composite resins has demonstrated that both glass, eg, Splint-It (Pentron Clinical) and ultra-high molecular weight polyethylene (UHMWPE) fiber reinforcement, eg, Ribbond THM (Ribbond) materials provide an increase in flexural strength and flexural modulus of composite resins.³⁹⁻⁴¹

Clinical evaluations of bonded fiber reinforced composite resins restorations for both splinting and for fixed partial dentures have been clinically successful.⁴³⁻⁴⁵ When selecting reinforcement fibers for use in periodontal splinting, since all such materials provide dental composite resins with equivalent reinforcement properties, ease of use and an assortment of widths of the fibers are primary criteria. In a multiuser evaluation, ease of use was a primary criterion for acceptance of use of bondable fiber reinforcement.³⁹

The following case report describes the use of a fiber-reinforced composite resin splint placed to stabilize a severely periodontally compromised dentition in order to evaluate tooth prognosis. Over the next 6 years, the patient's compliance in oral hygiene and periodontal maintenance improved the overall periodontal prognosis, leading to the treatment of the remaining maxillary teeth with a porcelain-metal fixed partial denture. This case report demonstrates that

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using the treatment techniques described when treatment planning similar clinical situations can lead to improved periodontal prognosis.

CASE REPORT

In 1991 a 40-year-old female presented to the dental school clinic for treatment. She had a past history of drug abuse, smoking, and psychiatric treatment for depression. Her first visit was due to acute pain that resulted in a tooth extraction. She expressed a desire to seek regular treatment. A treatment plan was formulated and she was diagnosed with adult moderate periodontitis. Over the next 6 years she sought only intermittent

Table. Clinical findings maxillary arch April 7, 1997

Missing: Nos. 1, 2, 3, 6, 13, 14, 15, 16	
General bone destruction: 60% bone loss; generalized 3 to 4 mm bone loss	
Widened PDL: generalized	
Mobility: Grade 1: Nos. 4, 7, 8, 10, 12	
Grade 2: Nos. 5, 11	
Grade 3: No. 9	
Furcation involvement: No. 12	
Infrabony Defects: Nos. 4-D; No.5-D; No.9-M; No.10-M	
Prognosis maxilla: 3 to 5 years guarded	5 to 10 years guarded
Adult moderate periodontitis	
Posterior bite collapse	
Primary occlusal trauma	

**Figure 8.** Eight-weeks post surgery.**Figure 9.** A 3-year recall of splint and porcelain veneers.

care, with treatment for dental emergencies relating to acute pain. In early 1997 the patient returned, and was examined and treatment planned. She had changes in her life circumstances that would lead to receiving more regular care and following through on treatment.

This narrative will focus on the patient's periodontal care and restorative recommendations based upon her periodontal conditions (Table 1) (Figure 1). One faculty member had suggested an immediate maxillary denture based upon the patient's periodontal status and financial limitations. The patient rejected the idea of extracting the maxillary teeth. For the patient's periodontal condition, scaling and root planing, occlusal adjustment to stabilize her occlusion, and periodontal splinting with a bonded fiber reinforced ribbon composite splint was planned.

Periodontal and occlusal trauma

**Figure 10.** A 6.5-year recall of splint: (a) facial view, (b) right facial view, and (c) left facial view.

contribute to tooth mobility. Due to financial considerations, the treatment plan for an occlusal adjustment and the placement of a fiber splint was based upon the patient's desire to not have a removable partial denture to provide for posterior support. In 1997, the placement and restoration of implants was not as commonplace as it is today, as furthermore, the cost of implant treatment would have made restoration of the posterior area with implants unfeasible for this patient. Although fiber splints would be a provisional solution considering the patient's extensive bone loss (60%) and significant tooth mobility

**Figure 11.** Preparations of the maxillary teeth for porcelain-metal fixed partial denture: (a) facial view, (b) right facial view, and (c) left facial view.

without posterior occlusal support, the patient was willing to have repairs of the splint as would be needed when fractures occurred. Teeth Nos. 4, 7, 8, 10 and 12 had degree 1 mobility; teeth Nos. 5 and 11 had degree 2 mobility; and tooth No. 9 was depressible with a degree 3 mobility.

Since the focus is whether or not splinting and tooth stabilization contribute to improvement in periodontal and tooth prognosis, treatment of the maxillary arch will be presented. As part of initial therapy all the teeth were scaled and root planed and polished (Figures 2a and 2b). To control

occlusion and occlusal trauma, the teeth were occlusally adjusted. Also, since the prognosis was guarded for many of the remaining maxillary teeth, the decision was to place a fiber reinforced composite resin splint to include all the maxillary teeth (Nos. 4 to 12) before pocket elimination surgery. The design of the fiber splint included endodontically treated tooth No. 5 where a double fiber ribbon would be placed into the pulp chamber, and this double fiber would be included in the pontic area of No. 6 to create a beam effect, strengthening the connectors of this directly placed fixed partial denture.³⁹ The advantages of a directly bonded fiber reinforced composite resin splint is that it is a single-visit procedure and allows for an evaluation of tooth prognosis before treatment planning a porcelain-metal fixed partial denture.^{1,31}

Maxillary splints placed on the lingual surface with reinforcement materials have the disadvantage of wear through the composite resin, perforating into the reinforcement material, and the forces of occlusion function against the bond to the teeth can lead to fracture and failure.^{25,46} Perforation into the fiber reinforcement material weakens the splint, and for the patient becomes a source of irritation due to the roughness created on the lingual surface due to the exposed fiber.^{41,45} With tooth preparation on the facial surface of anterior teeth to avoid overcontouring of the restoration (Figures 3) and occlusal preparations for the posterior teeth, the splint was to be fabricated. Placing the fiber reinforcement ribbon on the facial surface is indicated for patients with occlusion on the lingual surface^{46,47} and in clinical circumstances when the patient has a deep overbite.⁴⁸ A structural benefit of placing the fiber ribbon on the facial surface is that the fiber embedded into the adhesive composite resin is on the tensile side of the restoration, which places the forces of occlusion on the splint in a favorable direction. The fiber ribbon improves the flexural strength of the composite resin on the facial surface.^{40,41,45}

For this case, a UHMWPE leno-weave, lock-stitch fiber ribbon (Ribbond Reinforcement Ribbon, Ribbond) was used. After etching, and adhesive and initial composite resin placement, the fiber ribbon was placed (Figures 4a and 4b). The restoration was completed with facial veneering of the maxillary anterior teeth and a composite resin pontic for the No. 6 site (Figures 5a and 5b). The patient was shown how to maintain

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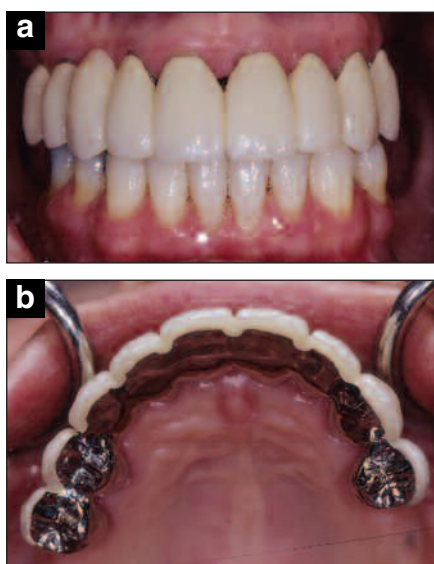


Figure 12. Completed porcelain-metal fixed partial denture (Nos. 4 to 12): (a) facial view and (b) lingual view.

periodontal health of the splinted teeth and remove plaque with a variety of interproximal cleaning aids.

Surgical treatment for pocket elimination included an apically positioned flap with osseous contouring (Figures 6a and 6b). The tissue was apically positioned using a modified vertical mattress suture to stabilize the gingival tissues apically on the teeth (Figures 7a and 7b). Eight-weeks post surgery, the healing was excellent (Figure 8). The patient had an aesthetic complaint of dark triangles in the gingival embrasures of the maxillary anterior teeth. The decision was to place porcelain veneers on Nos. 6 to 11. Since cost was a major factor in treatment decisions, the teeth were prepared for porcelain veneers, impressed, and temporized. The veneers (Cerinate Porcelain Veneers, Den-Mat) were fabricated and paid for with a research account. The patient was placed on a 3- to 4-month periodontal maintenance recall schedule. Over the next 3 years the patient reduced her smoking habit, and because of her own work and personal schedule, maintained a 4- to 6-month recall schedule for periodontal maintenance. Three years after treatment, the patient had excellent periodontal health with minimal periodontal pocketing, and the splint and veneers were performing at a clinically acceptable level (Figure 9).

Over the next 3.5 years the splint was repaired 2 times at the mesial and distal connector of the pontic on No. 6 with subsequent fracture of the porcelain veneer on tooth No. 7. At the 6.5 year recall the periodontal health was being maintained (Figures 10a and 10b). It was recommended to the patient that instead of repairing the splint and porcelain veneers, her periodontal prognosis was good and it was

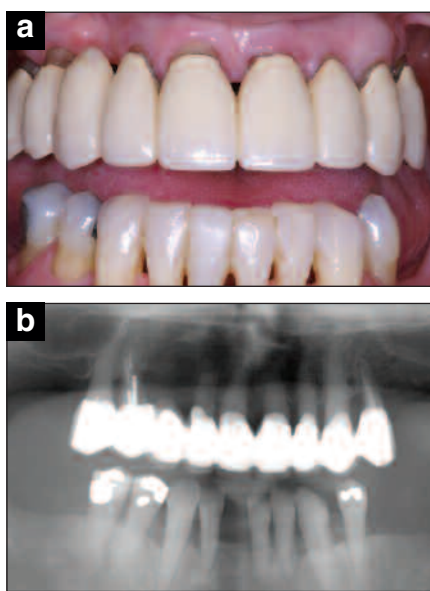


Figure 13. A 12-year recall of porcelain-metal fixed partial denture splint (Nos. 4 to 12): (a) facial view and (b) radiographic view.

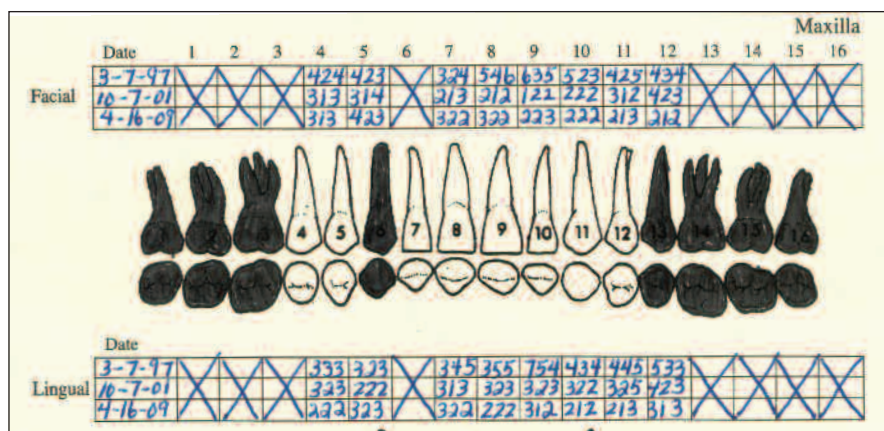


Figure 14. Comparison periodontal charting of probing depths from start of periodontal initial therapy, at 4.5-year recall, and at a 12-year recall.

time to restore the maxillary teeth with a porcelain-metal fixed partial denture. Her work situation and dental insurance allowed her to follow the restorative recommendations. The splint was removed and the maxillary teeth were prepared for a porcelain-metal fixed partial denture (Figures 11a and 11b). The completed restoration was cemented with a glass ionomer cement (Figures 12a and 12b).

Twelve years earlier, the patient was diagnosed with adult moderate periodontitis with a guarded prognosis for the maxillary teeth. After treatment of the maxillary arch with initial periodontal therapy of scaling and root planing, placement of a periodontal splint fabricated with a leno-weave, UHMWPE fiber ribbon (Ribbond) reinforced adhesive light-cure composite resin, and then surgically treated with an apically positioned flap with osseous recontouring, the patient was placed on a periodontal maintenance program. Six and half years after fiber-reinforced composite resin splinting, the patient's maxillary arch was restored with a fixed partial denture. At the 12 year recall, the maxillary teeth demonstrate

recession and cervical notching adjacent to the fixed partial denture but with minimal gingival pocketing and a diagnosis of gingivitis (Figures 13a and 13b).

During the last recall, the patient had mandibular anterior teeth and the missing mandibular incisor replaced with a composite resin pontic and fiber reinforced adhesive composite resin fixed partial denture (Ribbond THM, [Ribbond]). Note the probing depth changes prior to the initiation of periodontal treatment and splinting in 1997 and continuing over the 12 years of recall (Figure 14). The patient has maintained the remaining maxillary teeth.

CONCLUSION

In the past, the use of splinting of peri-

odontally compromised teeth was contentious. The presumption was that splinting to control tooth mobility was required to control gingival inflammation, periodontitis, and pocket formation. The use of splinting therapy in conjunction with control of occlusal trauma can contribute to improved prognosis of periodontally compromised dentitions. This article presents a 12-year recall case for a periodontally compromised maxillary dentition in which the teeth were occlusally adjusted and splinted as part of periodontal therapy. This patient was reasonably compliant in her attention to oral hygiene and following the periodontal maintenance regimen. Splinting of the maxillary arch has contributed to an outstanding result of changing the periodontal prognosis for the maxillary teeth from being "guarded" to "good." The patient is considering the placement of posterior implants to further stabilize the occlusal support and function.

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Test 117

To submit Continuing Education answers, use the answer sheet on page XX. Place an X in the box corresponding to the answer you believe is correct, detach the answer sheet from the magazine, and mail to Dentistry Today Department of Continuing Education. This article is available for 2 hours of CE credit.

The following 16 questions were derived from the article *Tooth Stabilization Improves Periodontal Prognosis: A Case Report*, by Howard E. Strassler, DMD on pages xx through xx.

Learning Objectives

After reading this article, the individual will learn:

- The effects of tooth stabilization on the long-term prognosis of teeth with mobility due to periodontal disease.
- A technique for stabilizing mobile teeth via splinting.

1. Mobility of teeth may be caused by:

- inflammation of the periodontium.
- loss of periodontal attachment.
- functional or parafunctional forces on teeth.
- all of the above.

2. A splint has been defined as an apparatus, appliance or device employed to prevent movement or displacement of fractured or movable parts. In dentistry splinting usually refers to joining teeth together to transmit stability to the entire restoration.

- Both statements are false
- The first statement is true, the second statement is false
- Both statements are true
- The first statement is false, the second statement is true

3. Tooth stability is important in occlusal treatment. According to Spear the goals of occlusal treatment are:

- to control loading that occurs at the temporomandibular joint.
- to control marginal leakage at the occlusal interface of restorative materials.
- to control load placed on the occluding surfaces of teeth.
- both a and c.

4. The primary reason(s) for periodontal splinting of mobile teeth is (are):

- primary occlusal trauma.
- secondary occlusal trauma.
- progressive mobility.
- all the above.

5. Primary occlusal trauma is defined as:

- wear on teeth during parafunction.
- injury that results from excessive occlusal forces applied to a tooth or teeth with normal periodontal support.
- injury that results from normal occlusal forces applied to a tooth or teeth with inadequate periodontal support.
- mobility of teeth due to gingival inflammation and bone loss.

6. Tooth mobility can be controlled with splinting therapy. Once the teeth are splinted the splint only needs to be in place for 6 months to one year to allow the teeth to stabilize, then it can be removed.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

7. Occlusion is an important component of periodontal health. Occlusal trauma and mobility in the periodontally compromised dentition can contribute to a deteriorating periodontal prognosis.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

8. Tooth mobility can be detected clinically and is described based upon displacement of the tooth crown when moved with 2 rigid dental instruments. The charting of tooth mobility is based upon the:

- Loe-Silness index.
- Miller Index.
- Dow Jones Index.
- Periodontal index.

9. The main reasons for stabilizing the periodontally compromised dentition with splinting include:

- reduces calculus deposition.
- reduces cervical caries.

- improves periodontal prognosis of mobile teeth.
- all of the above.

10. Periodontal splinting has been accomplished with all the following techniques EXCEPT.

- Fixed partial dentures (crown and bridge)
- Polyvinyl siloxane bonding
- Nonparallel pin splint
- Direct adhesive composite with fiber reinforcement

11. In the past, composite resins embedded with wires, metal mesh, and nylon mesh had clinical failures because:

- they were too narrow for teeth.
- they were too wide for teeth.
- they were too long for teeth.
- loading stresses placed on the splint during normal and parafunction caused fracture.

12. Composite resins are brittle materials. Bondable reinforcement ribbons and fibers of ultra high molecular weight polyethylene (eg, Ribbond) and glass, eg, (Splint-It), when embedded in composite resin with splinting, create a laminated structure with improved physical properties of the composite and a greater resistance to fracture.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

13. In the case report a maxillary splint with a leno-weave, lock-stitch ultra high molecular weight polyethylene ribbon (Ribbond) was placed on the facial surface. The reason(s) for placing the splint on the facial surface was(were):

- places the forces of occlusion on the tensile side of the restoration, resisting the forces of occlusion.
- avoids wearing through the composite, which would cause a perforation to the fiber reinforcement and weaken the splint.
- perforation of the composite into the fiber splint can cause roughness on the lingual surface due to exposed fiber.
- all of the above.

14. When using a fiber reinforced ribbon for splinting, after tooth cleaning and/or preparation, the tooth is etched, and adhesive and composite resin are placed. The fiber is then embedded into the composite resin before light curing.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

15. In the case report the fiber reinforced composite resin adhesive splint was placed to stabilize the patient's mobile teeth because of the guarded periodontal prognosis. As part of treatment the teeth were scaled and root planed, and after splinting, this patient had pocket elimination surgery because of the severity of her periodontal condition.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

16. The use of splinting therapy in conjunction with control of occlusal trauma can contribute to improved prognosis of periodontally compromised dentitions. The only type of splinting therapy that will work to stabilize teeth is fiber reinforcement of composite resin.

- Both statements are true
- The first statement is true, the second statement is false
- Both statements are false
- The first statement is false, the second statement is true

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