The Evolution of Temporary Fixed Splints—The A-Splint

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This article presents a review of the evolution of the temporary splint leading up to the present-day acid-etched composite, wire-reinforced, internal splint called the "A-splint." Nine general uses for the A-splint in the modern dental practice and some common problems are presented. (Int J Periodont Rest Dent 1998;18:277-285.)

For centuries dentists have been trying to stabilize loose teeth.1 In early scientific literature splinting was part of the therapy for "pyorrhea."2-11 The list of indications for splinting can be long, but it usually includes teeth that have loosened over time and missing teeth that require replacement. Often-listed advantages to splinting include: (1) facilitation of occlusal adjustment; (2) prevention of food impaction by stabilization of proximal contacts; (3) prevention of tipping, migration, or supereruption; (4) facilitation of healing of diseased supporting tissue; (5) retention of teeth with questionable prognoses; (6) support of terminal abutments for removable appliances; (7) enhancement of postsurgical healing; and (8) improvement of the psychologic morale of the patient. There is little research that would indicate when a splint should be used or if it has any value at all. However, most authors attest to the theoretic and practical benefits...
of splinting in one form or another. Ironically, most of the reports describing techniques and advocating temporary splinting come from the periodontal literature. The prosthodontic literature is surprisingly silent on this subject. This article will review many of the techniques presented in the past for temporary splinting and will describe nine general uses for splinting in the modern practice of dentistry. Common errors with temporary splints will also be presented.

Early history of splinting

Archaeologic excavations of the Etruscan society (eighth century BC to the first century AD) have found evidence of their use of wire ligation and gold bands to stabilize teeth. In the early 1700s Fauchard attempted tooth ligation. Litch has written of splinting techniques that date back to the early 1800s. Ottolengui, in 1889, used gold wire to stabilize loose teeth. In the early 1900s several authors described splinting techniques that dated back to the late 1800s.

Hirschfeld was one of the first modern periodontal authors to advocate ligation of periodontally diseased teeth using either stainless steel wire or silk. His technique was extracoronal and involved only the anterior teeth. Obin suggested cutting slots in the lingual aspects of anterior teeth and tying them together with acrylic resin. He also suggested reinforcing with 21-gauge stainless steel wire when posterior splints are attempted. Friedman used a cast buccolingual bar that was cemented and wired to anterior or posterior teeth. Pontics could also be added to this extracoronal cast splint. Simring advocated wrapping stainless steel wire or silk around anterior or posterior teeth and then covering the ligature with self-curing acrylic resin.

Harrington advocated cementing "u-shaped staples" into pin-holes 3-mm deep, cut into Class III proximal cavities of adjacent teeth and then covered with self-curing acrylic resin. Cross was the first to advocate a continuous amalgam splint into MOD preps on multiple posterior teeth. Lloyd and Baer and Friedman also advocated the continuous amalgam splint for posterior teeth. Elaborate matrices were required to confine the amalgam for this technique, and fractures were common.

Shatzkin expanded on Obin's technique by using stainless steel wire embedded in channels cut in the lingual aspect of anterior teeth and covered with self-curing acrylic resin. Alloy and Kato and later Liatukas advocated reinforcing the amalgam splint technique by embedding wire or silver root-canal points into the amalgam.

Block placed orthodontic bands on posterior teeth to then wired together. This was done to eliminate the tendency of extracoronal wires to slip gingivally. In an effort to reduce the fracture problems with the all-amalgam splint, Baumhammers cast 14-gauge chrome-cobalt bars and buried these bars into the MOD alloys. He also eliminated the complex matrix in favor of multiple individual matrix bands. Trachtenberg and later Schluger simplified the reinforced amalgam splint further by cutting channels into completed MOD amalgams, laying wire reinforcing into the channel, and covering the channel with self-curing acrylic resin. The main advantage to this combination "A-splint" is that the amalgams do not fracture and the danger of secondary caries from leaking acrylic resin margins is eliminated since the splint is confined within the amalgam restoration by the acrylic resin. If the acrylic and wire reinforcing comes loose or breaks, repair is relatively easy.

Terminology

The term "A-splint" was apparently popularized by Berliner and Kessler and has evolved into dental terminology as an easy way to describe the
wire-reinforced acrylic resin–amalgam splint. More recently, the term “A-splint” has come to include any splint that ties teeth together with acid-etched composite material; usually there is wire reinforcing included. The reliability of using acid-etched composite materials successfully has improved dramatically over the last decade, therefore, the use of amalgam with A-splints has diminished significantly. The adjective “temporary” is often associated with the A-splint, because most authors believe A-splints are temporary. The problem with the word “temporary” is that it implies time—are 5 or 10 years temporary? The authors have chosen to use the term “provisional splinting,” which connotes a transitional restoration providing protection, stabilization, and function before fabrication of a definitive prosthesis. No time factor is implied, and sometimes the definitive prosthesis is the A-splint.

Current use of the A-splint

With the development of acid etching and light-cured composite resins, splinting of mobile teeth has been greatly simplified. In many cases the simple acid-etch splint can be used, which requires no ligature reinforcing, cavity preparations, or pins (Figs 1a and 1b). Separate preparation of MOD amalgams for posterior teeth is usually unnecessary. If silver amalgam or cast restorations are already present, then mechanical retention can be used in these restorations to allow the use of wire and light-cure composite resin.

Provisional fixed partial denture postextraction

A provisional removable treatment partial denture for one tooth has many undesirable qualities. Extraction of the tooth, amputation of the root, and splinting the crown of the tooth as a pontic is a fast and economic method for avoiding removable treatment (Figs 2a and 2b). Even multiple teeth can be “A-splinted” when the need arises (Fig 3a). There are situations, such as in elderly patients or in patients with very limited economic resources, where the A-splinted fixed partial denture can serve as a long-term prosthesis (Fig 3b).

Periodontal splint

The need for periodontal splinting was the stimulus for the development of the A-splint. Many authors have demonstrated the use of A-splints to help prolong dentitions experiencing the ongoing ravages of periodontal disease. For many patients the A-splint offers a delay in extensive tooth loss and an alternative therapy that does not commit the patient...
Fig 2a (above)  Coronal half of the maxillary left central incisor is A-splinted to the right central and left lateral incisors as pontic after root was removed.

Fig 2b (right)  Radiographs spanning 3 years from A-splint to temporary A-splint fixed partial denture to final fixed restoration for patient in Fig 2a.

Fig 3a (above)  Coronal half of the maxillary left central incisor is A-splinted to the right central incisor and left canine as a pontic after the root of the left central incisor was removed.

Fig 3b (right)  Radiograph spanning 4 years from A-splint to temporary A-splint partial denture to final fixed restoration for patient in Fig 3a.
and the clinician to extensive and expensive conventional complete-mouth reconstruction. The complete-arch A-splint also allows the removal of teeth as the need arises without committing the patient to a removable prosthesis.

Periodontal splinting in conjunction with removable partial dentures

Some patients have protruding anterior segments resulting from the collapse of the posterior occlusal vertical dimension. Opening the vertical dimension and closing these anterior open spaces orthodontically is relatively quick and easy (Figs 4a and 4b). Retention of the anterior teeth is difficult, particularly when posterior teeth are missing. Complete, fixed cast splint restorations are expensive, and often the questionable periodontal prognosis does not warrant the expense. Also, the consideration of overdentures or complete dentures may be premature. Retention of the repositioned anterior segment with an A-splint may be a viable and acceptable alternative (Figs 4c and 4d).
Support for a conventional fixed partial denture (after abutment loss or with broken solder connector)

The long-term care for periodontally involved teeth often involves the disappointing loss of certain teeth. It is especially difficult when the lost tooth is an abutment for an extensive fixed prosthesis. The A-splint can be an acceptable solution in this situation.

Support for root resection

Root amputation is an acceptable therapeutic option for molar furcation involvement. Increased mobility following root amputation can be one of the undesirable side effects. A cast fixed splint may be premature and/or beyond the patient's financial ability. The A-splint can provide long-term economic support for this weakened condition (Fig 5).

Alternative to a resin-bonded fixed partial denture

The popularity of the resin-bonded fixed partial denture approach has declined over recent years. This is, in part, because of the failure of bonding systems to adequately retain the prosthesis. When debonding of one abutment occurs, the reattachment of that single abutment is unsatisfactory because of the clinician's inability to re-etch the surfaces. Re-etching and re-bonding an A-splint is extremely easy.

To prevent supereruption of opposing teeth

Clinicians often face the problem of removing a single posterior tooth, realizing the patient will never fill the space. One major concern is that the opposing tooth/teeth will supererupt into the space and create occlusal complications. The A-splint is a viable option for preventing this supereruption.

As a fixed orthodontic retainer

It is relatively easy to move teeth, particularly tipping movements on periodontally compromised teeth, but not as easy to make the repositioned teeth stay in place. The acid-etch splint or A-splint can be of great value in keeping minor tooth movement from relapsing.

To connect implants to natural teeth

As implant dentistry evolved into using implant fixtures for the partially edentulous patient, a controversy arose. Some authors felt the implant-supported...
prosthesis should not be connected to natural teeth. Some authors advocated a rigid connection between implant prostheses and natural teeth with copings, non-rigid attachments (keyways), and screw-retained attachments. Other authors have warned of the potential problems associated with joining natural teeth to implant-supported prostheses. More recently there have been several reports of intrusion of natural teeth when they were connected to implant-supported prostheses using copings and nonrigid attachments. The primary drawback of the screw-retained rigid attachment is the difficulty of the laboratory fabrication and the extreme precision needed to accomplish it. An alternative when multiple-implant fixtures are present is to use an A-splint between the natural teeth and the implant-supported prosthesis. This allows for some flexure at the A-splint and movement of the natural teeth independent of the implants, while still connecting the implants to the natural teeth.

Common problems

Overcontouring

The most common error with temporary splints is overcontouring. In an effort to make the splint strong enough to resist fracture, the clinician often increases the bulk of the composite resin, which results in impaired access for oral hygiene. The goal of the finished A-splint, particularly with periodontally compromised dentitions, should be to stabilize the weakened abutments without interfering with plaque control and access for professional hygiene. The ideal contours of a finished A-splint should follow the same principles as cast restorations and should allow for placement of an interproximal brush.

Esthetics

When A-splints were first used to stabilize mobile teeth, esthetics were sacrificed. With an internal lingual wire technique and the acid-etch composite materials available today, the A-splint can be very esthetic. Often esthetics can be enhanced by closing diastemas, covering or replacing old discolored restorations, covering discolored dentin or enamel, “bonding” chipped or broken teeth, and selectively recontouring.
Summary

The evolution of the temporary splint concept has been reviewed, starting with the first archeologic evidence of splinting by the Etruscan society and following the most significant discoveries through the present-day A-splint. Nine general uses for the modern dental practice are presented along with some of the more common problems encountered.

References


