



SPLINTING WITH 4 META/MMA-TBB SELF CURE ADHESIVE SYSTEM – A NOVEL APPROACH

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ABSTRACT

A variety of treatment modalities, for mobility of teeth. To treat the mandibular anterior mobile teeth is the most challenging tasks; to splint the mandibular teeth is appreciable approach and is the fastest, simplest and most predictable. This case report presents a successfully accomplished stabilization of mandibular teeth with grade II mobility with resorption of bone seen radiographically, by using 4-META/MMA-TBB self-cure dental adhesive resin (Cand B bond). This present treatment modality offers a conservative, aesthetic and noninvasive treatment which can be considered as a longlasting treatment. The purpose of this report is to present a case of successful stabilization of teeth by using Cand B bond.

KEYWORDS :

INTRODUCTION

Periodontitis is an inflammatory disease of supporting tissues of teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both.¹ Progressive alveolar bone loss around the involved teeth eventually results in increased mobility. Increased tooth mobility adversely affects function, aesthetics, and the patient's comfort. For stabilisation of hypermobile teeth, splinting is the ideal treatment line.² According to AAP, Splint is any apparatus, appliance, or device employed to prevent motion or displacement of fractured or movable parts. Dawson defines splinting as the joining together of two or more teeth for the purpose of stabilization.^{3,4} Splinting is valuable in ensuring the retention of periodontally compromised tooth and positively affecting the longevity.⁵ Splinting teeth to each other allows distribution of forces from mobile teeth to their immobile neighbours, thereby gaining support from stronger teeth. This prolongs the life expectancy of the loose teeth, gives stability for the periodontium to reattach, and improves comfort, function and aesthetics. Vályi et al reported that the stabilization of mobile teeth with splint allow the same healing like a nonmobile teeth. Splinting has also been shown to promote healing following periodontal surgery in localized aggressive periodontitis with resultant significant bone gain.⁶

One of the various adhesive used in splinting is superbond adhesive which has the strong bond strength, simple positioning, highly biocompatible and have esthetically appealing look. Superbond adhesive, a self-curing dental cement adhesive based on acrylic resin material, utilises "4-META" (4-methacryoxyethyl trimellitate anhydride)⁷ as a polymerization promoter. Although the dental adhesive 4-META/MMA-TBB self-cure dental adhesive resin cement method was recently launched in India (Super-Bond C&B by Sunmedical Co.),^{8,9} it was developed for general dental adhesive use in Japan in 1983. Over the years, it has built its reputation as a biocompatible dental cement adhesive with a strong bond strength¹⁰.

Classification Of The Splint

There are a variety of methods for splinting teeth. They can be categorised on the basis of their function and duration of use, the position of the splinted teeth in the jaw and the method of manufacture.¹¹

- Splints are categorised as metallic, non-metallic and a blend of metallic and non-metallic forms on the basis of materials.⁸ Metallic forms are typically made of stainless steel, chromium cobalt and cast metal, while non-metallic types are made of acrylic and composites.
- Splints are classified as fixed and removable on the basis of fabrication method¹²
- Splints are graded as extra coronal and intracoronal on the basis of the position of splinted teeth.
 - Extracoronal splints: In this technique, a stabilising wire, a fiber-reinforced ribbon or equivalent stabilising device is secured to the exterior of the teeth like a fixed orthodontic retainer. Other examples include tooth-bonded plastic, night guards and welded bands.
 - Intracoronal splints: a slot is milled into the damaged teeth and the stabiliser is inserted into the slot and bonded in place. This makes this kind of splint less noticeable for an aesthetic supremacy. Examples cover inlays and nylon wires
- Splints are categorized as temporary, Provisional or permanent on the basis of duration and purpose.^{12,13}
 - Temporary splints: Temporary splints are those utilized for less than 6 months during periodontal therapy that can or may not contribute to other forms of splints. It is used to minimise undesirable occlusal forces for a brief amount of time in post-acute trauma, as a protective intervention in the management of advanced periodontal disease and for anchorage in orthodontic treatment. Temporary splints may be removable, fixed external, fixed internal forms. Examples of removable temporary splints include Elbrecht cast metal splints, Hawley acrylic splints or other forms of orthodontic appliances, bite guards or night

guards. Examples of fixed external forms are:

- (1) Annealed 0,010 or 0,012 inches of stainless steel ligature wire, single or double, fixed to the teeth facially, lingually and occasionally incisally.
 - (2) A wire splint mixed with acrylic.
 - (3) Welded together by orthodontic bands
 - (4) cast splints of gold or chrome nickel alloy cemented to the teeth and the facial and lingual sections joined together with the ligature wire.
 - (5) The most common temporary splint is the one made from acid etch, self-polymerizing resin and composite material.
 - (6) Acrylic reinforced with an orthodontic grid material or cast metal frame. Example of fixed internal type metal wires with reinforced acrylic, put in an interproximal box of preparation with a mark of preservation to hold the teeth attached.
- b. Provisional splints: Provisional splints can be used for diagnostic purposes from several months to years and typically contribute to more durable forms of stabilisation. Amsterdam and Fox¹⁴ identified temporary splinting as the restorative treatment process using an immediate and temporary biomechanical combination of tooth dressing and teeth stabilisation. They are seen in certain circumstances where the end outcome of periodontal therapy during the initial care cycle can not be anticipated with confidence. They have details as to whether separating provides advantages prior to planning counselling. Examples include ligature cables, night watches and fixed prosthesis interims, polymer resin breaks (with or without protection for wire or fibre)
- c. Permanent splints: Permanent splints are permanently worn and may be either fixed or replaced. They aim at enhancing practical stability and a long-term enhancement in aesthetics. They are usually only placed after periodontal rehabilitation has been completed and occlusal stability attained. Examples include the form of pin ledge abutment, the partial denture which is clasp supported.

Case Presentation

History and examination: A 39-year-old male was seen in the department of Periodontics, Himachal dental college sundernagar. The chief complaint was mobile lower front teeth from 1 year. The patient was in excellent health with an unremarkable past medical history (no dental treatment was rendered). Clinical examination revealed a mandibular anterior teeth with generalized plaque and calculus. Generalized recession with mobility grade II 31,32,33,41,42 and 43. So the diagnosis is set to a generalized chronic periodontitis. The patient had a dentition without caries or restorations. After phase I therapy, Diocclusion was done wrt 31,32,33,41,42 and 43.

Steps In Positioning Of Splint

- (a) Teeth prophylaxis: The teeth surfaces have been thoroughly cleaned and polished to eliminate plaque, calculus and biofilm to ensure the highest bond strength. Contaminants and strains have been eliminated using a polishing brush and oil-free, fluoride-free pumice. The teeth were properly rinsed and cleaned.
- (b) Surface preparation After rinsing and polishing, the red activator was applied for about 30 seconds using a sponge swab to handle the tooth surfaces and wipe them dry. The activator shall be extended until an appropriate duration. If applied for a shorter amount of time, the tooth surface may not be sufficiently altered, but if the maintenance time is too long, the tooth surface will be severely modified that it becomes brittle or so heavily demineralized that Super bond monomers (4-META /

MMA-TBB) can not penetrate entirely into demineralized dentin. After treatment procedure, the activator must be completely rinsed.

- (c) Isolation of treated surfaces: After proper treatment of the adhesive surface, it is important to keep the surface dry. Contamination may occur by saliva, blood, water, oil or human breath, therefore rubber dam or cotton roll isolation is recommended. In some cases with hypermobile teeth, it can be impossible to position a rubber dam, and a gingival dam is recommended as an option in such situations to avoid interaction with adhesive monomer and polymer with oral soft tissue and to eliminate adhesive leakage to neighbouring surfaces that are not meant to be bonded.

Super-Bond's excellent adhesive properties to enamel, metal, plastic and porcelain make it useful for bonding a wide variety of orthodontic appliances. If tooth has slight mobility, it was splinted directly to the adjacent teeth. Because Super-Bond resists degradation in saliva, it creates an effective marginal seal between tooth and restoration. It not only bonds the restoration securely to the preparation to resist dislodging but also prevents leakage and secondary caries



Fig 1: Self-curing Adhesive Resin System (super-bond C&b)

Superbond can be applied in two techniques which can be either Brush dip or Bulk blending technique. Fracture and chipping can be quickly healed using a brush dip technique.

Brush-dip technique: The brush-dip process can be performed for around 5 minutes as long as the activated solvent stays active providing greater monitoring and precise application of the adhesive at the appropriate interdental touch points during the splinting procedure. As the powder / liquid ratio is higher in the brush dip technique than in the bulk blending technique, the working time of the mixed ball is relatively short and the curing time is longer than in the bulk mixing technique. The curing time of the brush-dip technique was estimated to be between 5 and 6 minutes at 37 ° C. Using a sterile dispensing bowl, a sufficient quantity of polymer powder was dispensed to the well "P" of the dispensing bowl. Fresh polymer powder should be separated from the container at any time. Do not use old powder left over from other operations. Do not add the remaining substance to the container because it might have been tainted with the activated oil.

An acceptable amount of drops (4 drops) was applied to the well "L" of the dispensing bowl during which one drop of the catalyst was put to the same well. The standard ratio of Monomer to Catalyst is 4 to 1 or 8 to 1. This prepared solution was called activated liquid which reacts with oxygen and gradually reduces its activity. The activated liquid should be used quickly, not more than 5 minutes after mixing. In order to achieve maximum potential bond strength, the dental adhesive must closely touch all surfaces to be bonded, one coat of the activated liquid (the combination of the Monomer and the Catalyst) on the tooth surface prior to the application of the C&B superbond, strengthens the bond strength. Brush tip (White) was dipped into the activated liquid in the well "L".

Excessive fluid was removed by applying the tip of the brush to the edge of the well. The brush is struck by the polymer powder in the "P" well. A small powder ball was picked up on the damp tip of the instrument. The Powder ball was rubbed onto the pre-wet surface of the contact points of the movable teeth. As soon as the brush reached the desired root surface, the powder dispersed to create a smooth, homogeneous coating. The process was repeated until the target surface was coated with cement. After each procedure, a gauze was used to clean the resin from the brush before dipping back into the oil. The brush with the pointed end brush tips (White) should be used in the brush – dip technique and these brushes are only used for one time.



Fig 2. Preoperative & Post Operative Intraoral View

Any adjacent surfaces that are not intended to be bonded should be protected. Any excess resin should be removed before it solidifies. After the procedure is completed, it is important that the splinted teeth remain immobile until the curing reaction is complete. As the teeth were hypermobile, the splint above was complemented by reinforcement by a composite resin-retained metallic mesh lingual splint.

Bulk blending technique: polymer powder is mixed directly to the activated liquid. When using this technique, SuperBond C&B first forms a low viscosity slurry immediately after the powder is added. This changes with time to a fluid state as the Polymer powder gradually dissolves in the activated liquid and polymerization progresses.

DISCUSSION

Over the last two decades, significant improvements have been made in the methods used to splint teeth. With the introduction of modern technologies and more technically efficient splinting techniques, more reliable and consistent outcomes can now be obtained. Application of Superbond C & B is possible in two ways, one is a method of brush dip, and the other is bulk blending. Direct resin fixation using brush dip technique is comparatively simpler compared to other conventional splinting methods and performs well due to the high bond strength and aesthetically acceptable appearance of the resin. This technique is more aesthetic, functional and comfortable and can be considered as a long-lasting provisional treatment. It is easier to bond, more aesthetically pleasing and an adjunct to periodontal therapy.

An adhesive resin, MMA/TBB has become one of the most reliable dentin bonding systems. Use of dentin conditioner 15 containing 10% citric acid and 3% ferric chloride (10-3) as well as primers containing metal ions such as ferric, ferrous, and cupric, or heme protein derivatives (cytochrome c and MP-11) improved the bond strength of MMA/TBB resin to dentin. Main mechanisms proposed to explain the role of 10-3 conditioner 16 in 4-META/MMA-TBB resin were:

- (1) Diffusion of monomers into the demineralized dentin surface,
- (2) Graft polymerization of PMMA onto dentin collagen, and
- (3) rapid initiation of polymerization at the resin-dentin interface.

Bond strength was affected both favourably and negatively by glutaraldehyde^{17,18} based on its concentration. Bond strength was lowered by sodium hypochlorite, hydrogen peroxide, cresol, eugenol and phenol camphor. Applying ascorbic acid to the dentine treated with Sodium hypochlorite will also regain the strength of the bond. In post-polymerisation behaviour¹⁹, TBB varied from other polymerisation initiator mechanisms including BPO / DMPT and CQ / DMAEMA. A smaller volume of residual monomer and a decrease in polymerized MMA resin over the long run have been caused by the use of TBB. Resin polymerisation is never an adequate state required for adhesive bonding. Various processes have been suggested for the development of durable dentine bonded MMA / TBB resin, including the dissemination of monomers into dentins, the graft polymerisation of resin into dentin collagen and the interfacial initiation of polymerisation.

CONCLUSION

Mobile teeth splinting is advocated for restoring function and comfort by developing a stable occlusion to encourage tooth retention and periodontal health maintenance. In contrast with other conventional methods of splinting the direct resin fixing procedure used with 4-META/MMA-TBB self-cure dental adhesive resin cement was found to be comparatively simpler and provides high bio-compatibility, strong bonding strength, aesthetic results and immediate stability much better than the majority of periodontal splint material that were available.

REFERENCES

1. Rajiv Saini, P P Marawar, Sujata Shete, and Santosh Saini Periodontitis, A True Infection J Glob Infect Dis. 2009; 1: 149-50
2. Splinting teeth – A review of methodology and clinical case reports. J Can Dent Assoc 2000;66:440-3.
3. Watkins SJ, Hemmings KW. Periodontal splinting in general dental practice. Dent Update 2000;27:278-85.
4. Zhang X. Effect of wire ligature splint reinforced with preparing groove and employing composite materials on the teeth with severe periodontitis. Hua Xi Kou Qiang Yi Xue Za Zhi 1997;15:138-40.
5. Splinting teeth – A review of methodology and clinical case reports. J Can Dent Assoc 2000;66:440-3.
6. Dodson SA, Takei HH, Carranza FA Jr. Clinical success in regeneration: Report of a case. Int J Periodontics Restorative Dent 1996;16:455-61.
7. Takeyama M, Kashibuchi S, Nakabayashi N, Masuhara E. Studies on dental self-curing resins (17) Adhesion of PMMA with bovine enamel or dental alloys. J Jpn Soc Dent Appar Mater 1978; 19: 179-185.
8. Unver S, Onay EO, Ungor M. Intentional re-plantation of a vertically fractured tooth repaired with an adhesive resin. Int Endod J. 2011;44:1069-78. doi: 10.1111/j.1365-2591.2011.01922.x
9. Nizam N, Kaval ME, Gurlek O, Atila A, Caliskan MK. Intentional replantation of adhesively reattached vertically fractured maxillary single-rooted teeth. Int Endod J. 2016;49:227-36. doi: 10.1111/iej.12444.
10. Ruzickova T, Staninec M, Marshall GW, Hutton JE. Bond strengths of the adhesive resin-amalgam interface. Am J Dent, 10(4), 192-194, 1997
11. Baruch H, Ehrlich J, Yaffe A. Splinting – A review of the literature. Refuat Hapeh Vehashinayim (1993) 2001;18:29-40, 76
12. Puri MS, Grover HS, Gupta A, Luthra S. Splinting – A healing touch for an ailing periodontium. J Oral Health Community Dent 2012;6:145-8.
13. Mittal S, Jain S. Tooth splinting: An update. Heal Talk 2013;5:38-9.
14. Amsterdam M, Fox L. Provisional splinting: Principles and techniques. Dent Clin North Am 1959;4:73-99.
15. Soeno K, Taira Y, Matsumura H, Atsuta M, Suzuki S. Adhesion of 4-META/MMA-TBB resin to collagen-depleted dentin – Effect of conditioner with ascorbic acid/ferric chloride. Dent Mater J 2004; 23: 100-105.
16. Soeno K, Taira Y, Atsuta M. Influence of formaline cresol on bond strength of adhesive luting agents to dentin. J Oral Rehabil 2000; 27: 623-628.
17. Baba N, Taira Y, Matsumura H, Atsuta M. Effect of disinfectants containing glutaraldehyde on bonding of a trin-butylborane initiated resin to dentin. J Oral Rehabil 2002;29: 478-483.
18. Sakamura A. Application of glutaraldehyde in dentin adhesion. J Jpn Dent Mater 1993; 12: 93-103.
19. Hirabayashi C, Imai Y. Studies on MMA-TBB resin I. Comparison of TBB and other initiators in the polymerization of PMMA/MMA resin. Dent Mater J 2002; 21: 314-321