

Modified R-Bridge for Comprehensive Aesthetic Rehabilitation of Missing Anterior Tooth in a Young Patient- A Case Report

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Abstract

Trauma due to avulsion accounts for 0.5 - 16% of all traumatic dental injuries to the permanent dentition and has a marked influence on physical, functional and psychological maturation of the affected individual. The esthetic and functional rehabilitation of a missing anterior tooth presents one of the greatest challenges that the dentist faces. While a number of treatment options, ranging from removable partial dentures to implants are available, there are several limitations of these therapeutic options. These extend from poor compliance for wear, disturbance in growth when they have to be used in young patients to the inability to withstand heavy masticatory forces. Resin bonded bridges present a minimally invasive, functional, cost effective and time saving alternative for replacement of a missing tooth. However, the disadvantages include weakening of the metal retainer by the perforations and wear of the resin at the perforations. Therefore, modifications may be introduced in the design of the bridge to address these limitations and reduce stress and abrasion thereby providing longevity to the prosthesis. This case report presents a clinical case of comprehensive rehabilitation for the missing maxillary incisor in a young patient using the R-bridge with additional structural modifications.

Keywords: Resin Bonded Bridges; Rochette Bridge; Aesthetic; Comprehensive Rehabilitation

Abbreviations

FRC: Fiber-Reinforced Composites; PFM: Porcelain Fused Metal; RPD: Removable Partial Dentures

Introduction

Trauma due to avulsion accounts for 0.5 - 16% of all traumatic dental injuries to the permanent dentition and is most commonly observed in young adolescents [1]. However, the prosthetic restoration of a missing central incisor poses a dilemma and is one of the most technique sensitive aesthetic procedures in dentistry [2]. Various treatment options are available for the management of

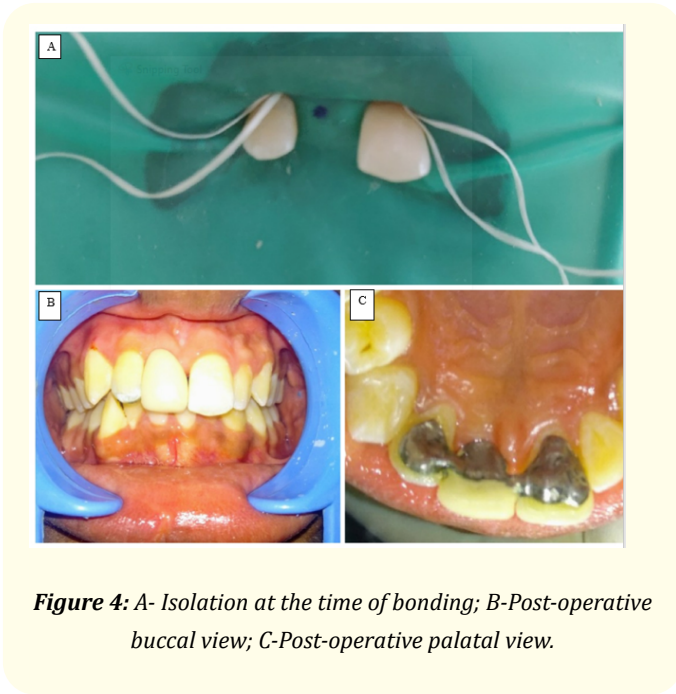
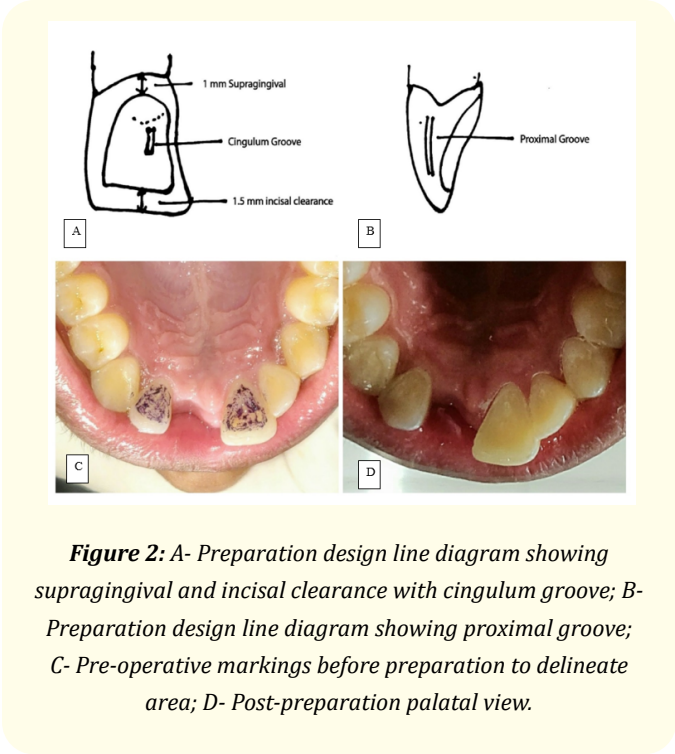
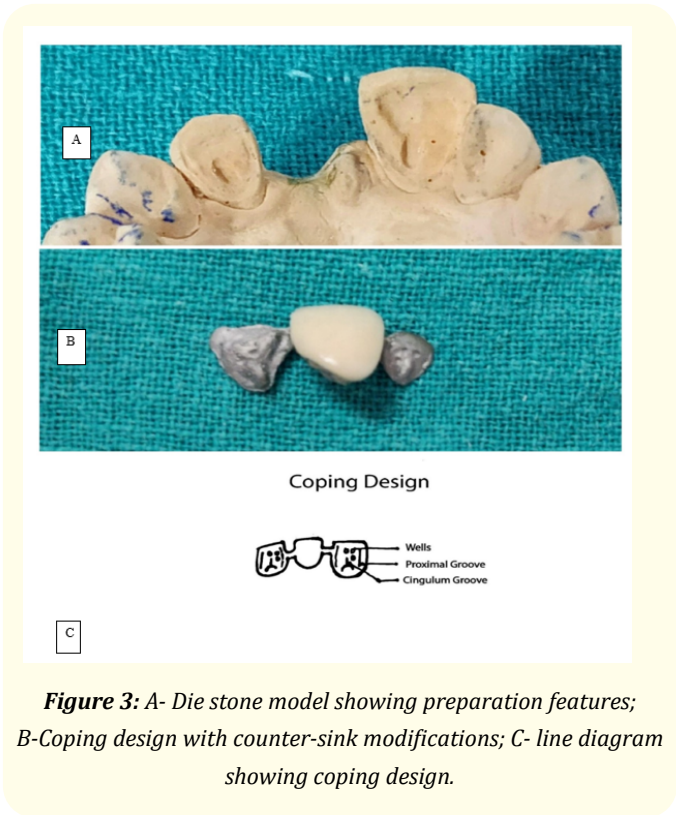
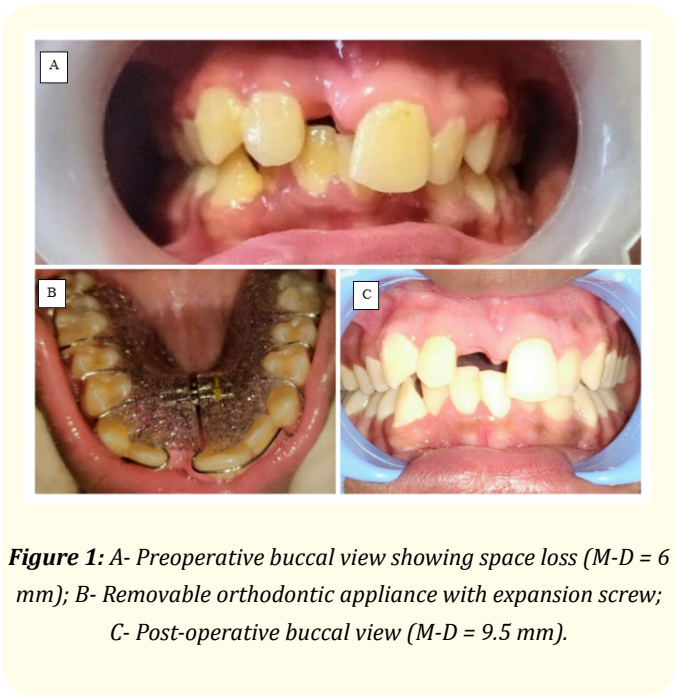
this condition including: replantation of the avulsed tooth, removable partial denture, porcelain fused metal (PFM) bridge, fiber reinforced composite resin bridge, resin-bonded fixed partial denture (Maryland bridge), dental implants (immediate or delayed) [3]. It is recommended to opt for removable partial dentures (RPDs) in a growing child until the permanent teeth have erupted, alveolar bone changes have decreased and the pulp chambers have receded to allow preparation for fixed replacement, yet the compliance for wear and aesthetics remains an issue with adolescents [4]. Fiber-reinforced composites (FRCs) introduced initially in the 1960s by Smith, are resin-based materials containing fibers to improve strength and physical properties. They contain glass fibers used to reinforce polymethyl methacry-

lates [5]. However, disadvantages of Fiber reinforced composite for single tooth replacement include difficulty in maintaining the oral hygiene and its questionable ability to withstand heavy masticatory load [6]. Implants behave like ankylosed teeth and become submerged as the surrounding bone grows. Thus, it is advisable to wait for cessation of facial growth prior to implant placement in adolescents [7]. Resin bonded bridges have been a minimally invasive option for replacing missing teeth and have been in use for over half a century. With added modifications in design they provide excellent patient satisfaction and longevity [8]. This case report presents comprehensive rehabilitation for the missing maxillary incisor in a young patient using the R-bridge for improved longevity and conservation of the tooth structure.

Case Report

A 14-year-old boy presented to the department of Paedodontics and Preventive dentistry with a chief complaint of missing upper front tooth for which he required replacement with fixed prosthesis. The patient had a history of trauma to the upper front tooth region 2 years back. The boy's medical history revealed no relevant findings. Extraoral clinical examination revealed no abnormalities. Intra - oral examination revealed loss of space in relation to lost upper right maxillary tooth. There were no soft tissue abnormalities noticed intraorally. The mesio-distal width available was compromised to 6 mm with class I caries in 16 and 26. Intra oral peri-apical radiograph revealed the void socket of 11 with compromised mesio-distal space availability of 6 mm. A conservative minimally invasive adhesive bridge was planned to restore the missing maxillary incisors. Preventive care schedule (phase I) was initiated for the patient, oral prophylaxis was done, oral hygiene instructions were provided and dietary counselling was done. Orthodontic slow expansion (phase II) schedule was carried out using a removable appliance with split labial bow until space correction to 9.5 mm followed by the retention phase (Figure 1A-1C). The patient was explained about fixed orthodontic management to further correct the crowding of the lower anterior teeth but he did not desire the long course of orthodontic treatment. A fixed, functional prosthesis was desirable which was conservative yet durable and economically affordable. Therefore, a resin retained FPD (modified Rochette bridge) was planned for the patient (phase III). Shade selection was done for the patient using the VITA 3-D Master

Shade guides. Minimal Crown preparation was done for the palatal aspects of 21 and 12. Occlusal marking was done and clearance of 0.5 mm was provided with a small diamond wheel. The preparation was 0.5 mm in depth, with a very light chamfer margin 1 mm supragingival, sparing incisal edge by 1.5 mm. Markings were made on the palatal aspects of teeth and palatal reduction was done using a small wheel diamond bur. A round end taper bur was used for proximal reduction producing a guide plane which extends slightly into the facio-proximal line angles while preparing a chamfer margin 1 mm supragingivally. A short needle bur was used to fabricate proximal grooves and cingulum grooves of 0.2 mm depth (Figure 2A-2D). A two-step impression was carried out using heavy body polyvinyl siloxane (Putty) impression (Aquasil, DENTSPLY Caulk, Milford, DE, USA) with the stock tray and spacer followed by light body impression (Aquasil, DENTSPLY Caulk, Milford, DE, USA) to record finer surface details. The framework was fabricated on a refractory cast. A wax pattern was fabricated as per design and investment and casting was done. 3 - 4 saucer-shaped wells of 0.2 mm - 0.3 mm diameter were made on the internal aspect of the metal framework sparing the margins by 0.5 mm. The wells were in place of countersinks on the tooth structure for added conservation of the enamel structure and to further improve retention and improve durability (Figure 3A and 3B). The resin rivets that were exposed through the framework as per the Rochette design (1973) [9] lead to increased stresses, abrasion and diminished longevity [10]. Therefore, the perforations were replaced with shallow wells on the internal surface of the metal framework. Porcelain build up was done and shade matched. An ovate emerging profile was given to improve esthetics. The internal surface of the metal was air-abraded with 50 micrometers of alumina freshly before insertion. The prepared abutments were cleaned using prophyl paste (Detartrine z, Saint Maur des Fosses, France) followed by 60s of acid-etching using 37% phosphoric acid. The resin retained FPD (modified Rochette Bridge) was bonded under isolation (Figure 4A-4C) using 3M Unitek Unitek bonding primer and adhesive which was chemically cured due to lack of light penetrance through the metal. The FPD was held under digital pressure to secure its place for 120 seconds. At the end of bonding the prosthesis, the patient was given instructions and occlusal interferences were checked. The patient was followed up every 3 weeks for the next 6 months and remained satisfied with the prosthesis both with both esthetics and function (Figure 5).



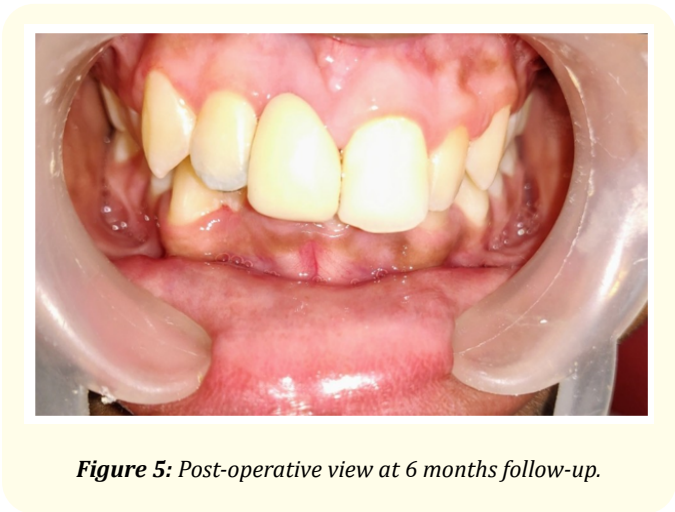


Figure 5: Post-operative view at 6 months follow-up.

Discussion

Era of adhesive dentistry dates back to 1955 when acid etching was introduced by Buonocore [11]. Ibsen first described the use of an acrylic resin pontic to an unprepared tooth using composite resin. In 1973 Rochette of France introduced the idea of bonding a cast metal bar to the lingual surfaces of periodontally involved anterior teeth for splinting purposes using the acid-etch technique and an unfilled resin cement [9]. The first use of wing-like retainers with funnel-shaped perforations was used with a silane coupling agent to increase mechanical retention. Livaditis and Thompson proposed that the resin ‘rivets’ extruding through the metal are exposed to abrasion, stresses and lead to diminished longevity [10]. Since thereon, various modifications in the design and metal-resin bonding techniques have been proposed (Table 1). In the present case, we worked with the standard Rochette design and modified it wherein the through and through funnel-shaped perforations were replaced by shallow saucer shaped wells on the internal/bonding face of metal to limit stress and abrasion and provide longevity to the prosthesis. Fiber-reinforced composite retained fixed bridges are a popular option for the metal free restoration and minimal preparation, but their use is technique sensitive and potential wear of the composite and uncertain longevity should be considered. In the presented case, as the patient would be unable to afford implant in the future years, the traditional option with increased longevity, durability, better wear resistance and biocompatibility for the periodontium was chosen. The dental resin composite based pontic is known to cause gingival cell apoptosis due to leeching of monomers during the initial conservation phase [12],

whereas the porcelain/ zirconia material causes negligible marginal gingival irritation [13]. Resin bonded bridges are relatively cheap, require little or no damage to the surrounding teeth during preparation, and it is well tolerated by patients. Success rates are found to be as high as 80% after 15 years in the anterior maxilla². Systematic reviews have estimated the five-year survival rates for bridgework as 87.7% for resin bonded prostheses, it is also seen that rebonding of the metal frame after dislodgement increased the survival rate to 87% after 8 years [14] thus proving its viability.

SL no.	Year	Author	Design: key features
1	1973	Rochette	Rochette Bridge: Funnel-shaped perforations, winged metal retainers, mechanical bonding, silane coupling
2	1982	Livaditis and Thompson	Maryland Bridge: Electrolytic etching of metal -3.5% nitric acid with a current of 250mA/cm ² for 5 min, followed by 18% Hydrochloric acid in an ultrasonic cleaner for 10 min
3	1984	Heinenberg	Cast mesh FPD: Net-nylon mesh for improved retention
4	1985	Moon and Hudgins	Virginia Bridge: Particle roughened retainers by incorporating salt crystals (sieved salt crystals 149-250 microns)
5	2006	Heymann	Carolina Bridge: Porcelain pontic with resin connector and minimal proximal preparation

Table 1: Modifications in design and metal-resin bonding techniques.

Conclusion

A) Modern day pediatric dentistry is atraumatic, holistic and minimally invasive. B) The resin retained FPD continues to be a durable, esthetic and conservative option and holds its place alongside other alternatives.

Truly contemporary dentistry delves into the historical roots of knowledge and bearing their experience in mind tactfully modifies them to the best advantage for the patient and the dentist.

Conflict of Interest

The manuscript has no conflict of interests.

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