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Research Paper

Anterior Missing Teeth with a Fibre-Reinforced Adhesive Bridge in Paediatric Patients: Case Report

Dr. Hanali Abu Shilbayih
Department Of Orthodontics And Pediatric Dentistry, Al-Quds University, Jerusalem, Palestine
Corresponding Author; Dr. Hanali Abu Shilbayih
Department Of Orthodontics And Pediatric Dentistry
Al-Quds University
Jerusalem, Palestine

Abstract:
To replace a congenitally or traumatically missing permanent anterior tooth, different therapeutic options are available. Fixed anterior fiber- reinforced composite resin bridges represent one of these options, with many advantages including bondability, reparability, ease of fabrication, and relative longevity. It is considered a minimally invasive procedure with very little loss of dental hard tissue. The case describes the fabrication of a unilaterally fixed anterior fiber- reinforced composite bridge in a 15- year- old girl. Using this technique, it is possible to temporarily replace a missing anterior tooth until a definitive restoration can be inserted.
KEYWORDS *case report, fiber-reinforced composite bridge, minimal invasive, operative dentistry*

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I. INTRODUCTION

Anterior tooth loss can be treated with various modes of treatment cited in the literature. Osseo integrated implants, Fixed partial Dentures, Removable partial dentures, Resin Bonded Bridges and Fiber reinforced fixed partial denture are the ways for treatment for replacement of missing anterior tooth.[1] Resin bonded prosthesis is a fixed partial denture which is cemented to the tooth structures, primarily enamel, etched to provide micro-mechanical retention for the resin luting agent (Rochette or Maryland Bridge).[2,3] The disadvantages can result in the bonding and esthetic problems of metal frameworks.[4]

Over the past few years, the development of fiber- reinforced composite (FRC) has offered the dental profession a variety of clinical applications.[5] It provides the possibility of fabricating resin-bonded, esthetically acceptable, and metal-free tooth restorations for immediate teeth replacement.[6] This material can be directly processed intraorally, shows good adherence to natural teeth, and has with adequate strength to withstand masticatory forces.[7] Also, prefabricated FRC posts, composed of glass fibers embedded in a polymer matrix, can be considered as viable alternatives to metal post systems in the restoration of endodontically treated teeth.[1,3,7]

Figure 1: Intra-oral picture showing missing 22

The mechanical properties are determined by the fiber type, fiber architecture and the quality of the fiber/matrix coupling. In vitro studies proved that the flexure strength of fiber reinforced composite materials are greater than or comparable to metal alloys but have low flexure modulus.[8] With help of researches, the

mechanical performance was shown to be improved by effective penetration and wetting of the fiber bundles by the resin .Even day,these fiber reinforced composite fixed partial denture sroutinedly used as a permanent treatment option in replacement of missing anterior teeth.[9,10]
This case report presents a technique to replace missing single anterior tooth using fiber reinforced composite – fixed denture with preparation of the abutment teeth.

CASE REPORT

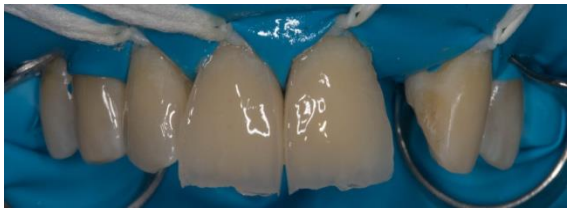

Figure 2.; Modeling of the Centrals incisors by composite layering technique

A 15 years old female patient was referred to my Paediatric Dental Clinic,Jerusalem,Palestine , for the treatment of missing of permanent upper lateral incisors #22 teeth (Figure 1). During the past two years she wore a fixed orthodontic appliance, and at the end of orthodontic treatment at the age of 14 she was rehabilitated with partial denture as a temporary solution. Partial denture was not satisfactory treatment aesthetically or functionally causing the patient emotional insecurity . Figure 2.

Figure 3. ;Application of special adhesive to enamel before adaptation of fibers

After clinical examination and analysis of panoramic x-ray, impressions were taken for the study models. Their analysis in an articulator showed sufficient interocclusal space between the upper and lower anterior teeth to create fiber-reinforced adhesive bridge without the need for preparation of abutment teeth. Diagnostic modeling of upper lateral incisors was done so that the patient would have insight into the future restoration and a silicone key was designed for modeling missing incisors on the basis of test modeling in wax . In one visit, the adhesive bridge was made using a GC everStick C & B Fiber (and a set of GC Gradia composite materials with the aim of temporary restoration of missing teeth. EverStick C & B fiber is made of over 4000 E salinized glass-fiber surrounded by bis-GMA and polymethyl methacrylate (PMMA). The required length of the fibers was measured on the study model. The fibers were the length of interproximal space and a few mm longer on palatal surfaces of the abutment teeth. Enamel on palatal and proximal part of abutment teeth was etched with 37% phosphoric acid, rinsed with water, air dried and a thin layer of universal self etch adhesive G-aenial bond (GC, Europe) was

Figure 4. Modeling of the lateral incisor by composite layering technique

applied (Figures 3). After curing a thin layer of flowable composite GC G-ænial Universal Flo was applied on prepared tooth surface. The fibers were placed using a special StickStepper instrument (GC, Europe) and then connector on one abutment tooth was light cured for 5-10 sec, while protecting with the instrument premature polimerization of the entire adapted fiber (Figures 4,5). Then after polymerization was carried out on the other connector. Gradual application and polymerization of the liquid composite layers formed the basis of the future

adhesive bridge. The rest of the bridge was modeled using GC Gradia Direct composite . The same procedure was repeated for the second adhesive bridge.

Figure 5.; Modeling of the lateral incisor by composite layering technique

The occlusion was checked and the restorations were polished (Figures 6,7,8,9). On the follow-up examination after two months, there was no observed damage of the bridges and a good oral hygiene was established. Patient was very pleased with the appearance and function of adhesive bridges.

II. DISCUSSION

Different therapeutic options can be considered for the replacement of missing permanent incisors in young children and adolescents. Implants are often the treatment of choice and should be considered when general and local conditions are favorable.[3,4] However, implant insertion is generally not intended before the end of the growth period around the age of 18 years.[11] However, dento- alveolar growth is not strictly depending on chronological age, but occurs parallel to hormonal changes and

FIGURE 6; Subsequent dentine core layering with D1 and D2

therefore differs significantly between males and females. Another limiting factor might be the patient's financial background, as dental implants are expensive.[11] More economically acceptable treatments should therefore be regarded for the replacement of a missing tooth, as a definitive solution or as a long- term provisional treatment before implant therapy.[7,11] Removable partial dentures are often considered for very young patients when adjacent teeth are not in their final vertical and horizontal positions. They are not comfortable, however, and according to our experience, are frequently subjected to fracture. When an orthodontic treatment is indicated, an artificial plastic tooth could be attached to a removable or fixed orthodontic appliance to address the aesthetic concern. The replacement of a missing tooth can also be realized via a conventional bridge or a resin- bonded fixed partial denture .[6,7,8,11]

Figure 7 : Final frontal view of the FRC resin bridge after the rubber dam removal

Noninvasive or minimally invasive approaches for replacement of missing teeth especially esthetically demanding anterior teeth is advancing with the advancements in the materials techniques of adhesive dentistry. Pre-impregnated fiber reinforced composite provides chairside immediate fabrication of fixed partial denture minimal or nil preparation of the abutment teeth .[12]

Fiber-reinforced composite resins can also serve as immediate, minimally invasive, reversible, single visit, and cost-effective alternative for anterior tooth replacement.[2] Fiber-reinforced composite, made up of glass fibers, is the only existing esthetically acceptable material, which can be processed directly in the mouth to form the framework of a bridge, simultaneously adhering to the adjacent teeth with adequate strength to withstand the masticatory forces.[5-8]

Ever Stick™, an FRC material, is made from unidirectional glass fibers and a polymer/resin gel matrix. The polymer/resin gel matrix holds the individual glass fibers in a bundle, which facilitates handling of the fiber bundle. The fiber bundle is flexible and tacky, which allows its easy and reliable bonding to teeth. This design makes the glass fibers flexible but prevents the fraying of the material from within the matrix when adapted to a surface.[13]

Fig. 8: Palatal view of the FRC resin bridge

In 2002, Freilich et al evaluated of 39 light and heat polymerized fixed partial bridges made with a substructure of preimpregnated, unidirectional FRC, veneered with a hybrid particulate composite. Each of the prosthesis was assessed for surface integrity, anatomical contour, marginal integrity, and structural integrity. The results showed that survival was associated primarily with substructure design volume. The survival rate was 95% for prostheses made with a high-volume substructure, when patients with severe parafunctional habits were excluded. This study shows that a unidirectional, preimpregnated FRC can be used successfully to make bridges of variable retainer designs that last up to 4 or more years when a high-volume substructure is used.[2] In 2003, Li et al. studied the failure modes and failure locations of the direct FRC dental bridge structures with and without adjacent teeth experimentally.[14] The experimental results show a good agreement with the clinical observations. It is found that the bonded interface is indeed the weakest region in the composite bridges. Also, it is suggested that the composite resin reinforced with high modulus polymer fibers and the presence of adjacent teeth could significantly increase the structural strength and stiffness of the bridge and therefore improve its clinical performance.[21]n 2005, Visser and Rensburg did a study to review FRC as an alternative to tooth replacement in South Africa. Although the use of FRCs for this purpose is relatively new in South Africa, 5 years clinical results are very promising .It is not necessary to prepare adjacent teeth, so the biological costs are low. In fact, it makes more sense to conserve as much as possible that part of the tooth which displays the best bonding surface in the oral cavity, that is, the enamel of the tooth. Additionally, as this technique is reversible it allows other restorative options to be evaluated at a later time. These restorations offer a viable alternative to more expensive fixed or removable prostheses.[15]

Shinya et al. in 2008 studied the stress distribution in anterior adhesive fixed dental prosthesis and at tooth/framework interface. The design of FPD consists of retainers in maxillary central and canine and pontic lateral incisor. Two different materials were compared: Isotropic Au-pd alloy and anisotropic

Figure 9.; The appearance of the completed left adhesive bridge

continuous unidirectional E-glass FRC. A three-dimensional FE model of 3 U FPD with 154 N loading was analyzed to determine the stress distribution at FPD and adhesive interface. The general observation was that the FRC-FPD provided more even stress distribution from the occluding contact point to cement interface than did metalFPD.[16]Matheus et al. in 2010 used optical coherence tomography (OCT) compared to scanning electron microscopy and optical microscopy to evaluate qualitatively crack propagation and final fracture in restorative composite materials with fiber-reinforcement after cyclic loading. The failures were analyzed using the three methods described. OCT permitted good characterization of internal crack propagation. The results indicated that the deformation occurred in the dental composite and fiber in the direction of the force.[17]

Figure 10. ; Situation at the follow- up after 1 year

Fiber- reinforced composite bridges represent an interesting alternative to conventional metal- based bridges. They can be realized directly or indirectly.[18] In the direct method, an artificial plastic tooth or the avulsed or extracted tooth can be used. An alternative is a direct tooth built- up using composite resin. The decision to replace the left lateral incisor directly using composite and to fix it unilaterally with a preimpregnated fiberglass ribbon.[19]

Valittu and Sevelius evaluated 31 specimens and found a success rate of 93% at 24 months. In a 37-month follow-up of 39 FPDs made with a framework of pre-impregnated, unidirectional fiber reinforced composite.[20]

The advantages of the fiber reinforced adhesive bridges include short-time application, aesthetic application with composite resins, no undesired color as no metal construction material was available, and no harms upon the neighboring teeth as performed with minimal invasive method and its being recycle .[9.21,22] Its disadvantages include fracture risk during chewing and fragile techniques required for manufacturing .[14]

Doğan et al reported in their case report in which glass fiber was usedthat no malfunctions and aesthetic loss were detected in the 1 year of follow up of the fiber reinforced composite.[23]

Kumbuloglu O. et al in their 5-25 years of clinical follow ups performed with fiber adhesive composites reported that success ratio of metal constructed adhesive composites was 76% and this ratio was 93% in the fiber reinforced composite restorations.[24]Our cases also did not present with any problems in the end of 2 years. On the other hand, we consider that longer clinical follow up be realized in order for accepting the restoration as successful.

According to the results of 5-25 year follow-up periods, the success rate of metal structure adhesive bridges has been reported as 76%, while this rate is 93% in FRC restorations.[25] The restorations in the current case were seen to function successfully in the mouth at the end of one year. Figure 10.

III. CONCLUSIONS

In conclusion, the fixed anterior fiber- reinforced composite resin bridge fabrication technique suggests an alternative treatment option for the temporarily replacement of a missing anterior tooth. Using this technique, it is possible to restore esthetics and function. Clinical long- time studies have to show whether it can also serve as a permanent restoration.

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CONFLICT OF INTEREST

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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