Restoration Of A Severely Damaged Crown With Chopped Glass Fibers And Core Build-Ups : A Clinical Report

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Abstract

This article aims to describe a technique using glass fiber post with an interpenetrating polymer network (IPN) polymer matrix, and chopped the same as glass fibers core build-up material to restore a tooth with a significant loss of crown structure. Following the root canal therapy, the post was bonded into the canal and the core 4mm of chopped glass fiber bundles were used to- the core of build up a block on the bonding surface of the glass fiber post so as to strengthen the post and core assembly. Prefabric core build ups were used to shape the core form easily. Zirconia full ceramic crown was fabricated and the patient was satisfied with the treatment. Restoration was examined to remain succesful after 1 year.

INTRODUCTION

It is obviously known that endodontically treated teeth are often damaged by fractures, previous restorations, decay, extensive wear or decreased moisture content, resulting in a little of remaining coronal tooth structure. As such, they require a post to retain the crown[1].

For this purpose, the cast metal post and cores have been the dominating restorative approach to provide the necessary retention for the subsequent crown restoration for these teeth in the past several decades.[2] However, the presence of a metallic substructure, which is a total barrier to the transmission of light, relatively time consuming, demand extra clinic and laboratory time, may pose a risk for root fracture, mechanical properties of rigidity and the use of metal alloy posts and cores under the all ceramic crowns exhibit esthetic problem.[3]

Currently, the fiber reinforced post systems have changed the prevailing situation, and they have been advocated as an ideal choise for matching the natural dentition for the characters of non-metal post and core build-up and inherent translucency. [4]Among the other fiber systems, glass fiber reinforced posts are easily bonded to tooth structure and have a modulus of elasticity similar to dentin. This property may concentrate less stress in the tooth and reduce the incidence of catastrophic root fractures. [5]

Several brands of glass fiber systems for posts available, including Ever Stick posts are made of an interpenetrating network (IPN) polymer, having silanated glass fibres impregnated with an IPN resin matrix. Ever Stick contains polymethylmethacrylate (PMMA) as a linear phase and bis-GMA as the cross-linked phase of the polymer matrix. PMMA chains, plasticize the cross-linked bis-GMA based matrix of the Ever stick and thus reduce the stres formation in the fiber matrix. [6]

The ability of a post-core to distribute stress can be affected by both material and form of the core. Core build up materials should exhibit good adaptation and reliable bond strength to the post surface.[7] Prefabric core build ups provide fast and easy manipulation to shape the core form and finally a strong and esthetic restoration.

The purpose of this study is to describe a glass fiber post and glass fiber core build-up and all ceramic zirconia crown strong enough to be used to restore two premolares teeth. The influence of using chopped glass fibers as a core material provides esthetic, conservative and easy cementation technique on the resistance of the tooth was also evaluated.

PATIENT PRESENTATION

Our patient was a 42-year-old woman with a noncontributory medical history. She had an excesively damaged premolar tooth (tooth 25). The root canals were filled with vertically condensed warm gutta-percha (Guttapercha Points, Dentsply DeTrey, Konstanz, Germany) and endodontic resin sealer. Two weeks after endodontic

treatment, roots were prepared for post placement. Rubber dam was used to avoid the area from moisture for adhesive procedures. Root canal space was prepared with Gates drills (Antaeos, VDW GmbH, Munchen, Germany), to length of 8–9 mm; at least 3–4 mm of apical seal was maintained. The length of the glass fiber-reinforced post (Everstick, Turku, Finland) was measured using endodontic files. The root canal was rinsed and dried with sterile paper points (Absorbent Paper Points, Dentsply DeTrey, Konstanz, Germany). Etching gel 37% phosphoric acid (3M ESPE, St Paul, MN, USA) was applied to the post space for 15 s and rinsed off with water using an endodontic syringe then dried with sterile paper points. A single coat of dual-cure adhesive system (Single Bond 2, 3M ESPE, St Paul, MN, USA) was applied following the manufacturer's instruction using Microbrush fine (Microbrush International, Grafton, USA) and then cured with LED light source of 1000 mW/cm ^{2} intensity (Elipar Free Light 2, 3M ESPE, St. Paul, MN, USA) for 10 seconds. Fiber post was wetted with bonding resin, then cemented with dual cure resin cement. To fit with the diameter of the canal, an Ever Stick Post (Stick Tech Ltd, Turku, Finland) with a diameter of 0.9 mm was used. A dual-cure composite resin cement (Rely X-ARC; 3M ESPE, Seefeld, Germany) was applied to the post space with a Lentulo spiral (Dentsply Maillefer, Ballaigues, Switzerland) and on the post surface and then the post was seated. After removing excess cement, the correct position of the post was verified and the resin was light-cured for 20 seconds. For the purpose of the reconstruction of the coronal tooth structure, core build-up was performed using matrix directly over the fiber post with chopped 4 mm length glass fibers.

Core structure was shaped with chopped glass fiber bundles and flowable composite(Flowable Stick Tech Ltd, Turku, Finland) by using a core form (Clearfil Core Form, Kuraray Medical Inc., Okayama, Japan). Core form materials provide fast and easy manipulation. Light was positioned above the core for 40 seconds on each side. After tooth preparation with diamond burs, final restoration was finished with full ceramic zirconia crown. Zirconia ceramic crown was bonded to composite resin core with a resin luting agent containing a phosphate monomer (Panavia F, Kuraray) according to the manufacturers instructions. Excess resin was removed with a help of brush. The luting agent was polymerised for 40 seconds on each side of bonding area.

Occlusion was evaluated and premature contacts were removed in sentric, lateral, latero-protrusive and protrusive movements.

During the recall appointment, an assessment of the stability and longevity of the restoration was also performed. Color stability, surface staining, and retention due to fracture of the post or fracture of the glass fibers build-up restoration was evaluated and found to be acceptable. It was found out following the study that the patient had no complaints about the restorations.

Figure 1

Figure 1 Intraoral view of the damaged crown before treatment

Figure 2

Figure 2 Glass fiber posts in the root canals

Figure 3

Figure 3 Core structure by chopped fiber bundles and core form

Figure 4

Figure 4 Intraoral view of the final all ceramic restoration

DISCUSSION

This clinical report presents the treatment of significant loss of coronal tooth structure of two maxillary premolares using glass fiber-reinforced material to increase strength as an alternative and different technique for restoring the aesthetics and function of teeth, here seemed to be effective in treating highly damaged teeth. The use of chopped glass fiber core build-up as the one used in the present case is an esthetically excellent translucent restoration that appears very useful under all the ceramic crown.

The clinical use of glass fiber posts have been increased tremendously since they were introduced in the 1990s[6]. The biomechanical properties of these posts have been reported to be close to those of dentin, the rigidity of the post being equal or almost equal to that of dentin, so as to distribute the functional forces evenly along the length of the root. Their resistance to corrosion and fatique and option of easy removal of post from the root canals are advantages of the glass fiber posts[8].

Core build-up materials should exhibit good adaptation, and a reliable bond to the post surface. Ideally minimal voids should be present along the interface between the post and the core, as these voids may act as stress raisers and initiate mechanical failure[9]. If either the post and/or the core build-up material fails, the crown will ultimately fail. Therefore, the retention of a post and the stability of a core is an important factor in preventing restoration failures. Glass fiber post is chemical adhesion with bonding cement and composite cores. The use of dual-cured or self curing resin-based cements has been reccomended to bond glass fiber reinforced, resin based composite posts to root canal walls.[7]

Recently, bonding techniques have been introduced to improve the retention and resistance of the cores. Light or dual cured composite resins are also commonly used as core materials to help in distribution of stresses to the surface underneath the core, thus creating less cervical stresses. Resin composites, with various tooth-colours, have become popular as the core material for its comparative flexibility and satisfactory esthetics, especially under an all-ceramic restoration[10]. Different resin composite materials are available in the market to build-up root-filled teeth. Although composites that are specifically designed for core build-ups are available hybrid and flowable composites have also been employed for the same purpose in recent years[3].

In the present study, chopped glass fibers and flowable composite, that is specifically designed to be used with glass fibers, were used to form the core structure with build-up materials.

It is desirable to develop post and adhesive systems which demonstrate increased bond strength values[6]. Yaman et al reported that stiffer core material increases the cervical stresses and diminishes apical stres. This was considered to occur because of inhibition of the intrusion of the loaded

posts. The authors concluded that the level of load-bearing capacity of the direct cores was sufficient to withstand physiologic forces 33 Therefore, if excessive load is applied to the tooth, the post will be able to absorb stresses, reducing the possibility of root fracture[11].

CONCLUSION

Glass fiber posts provide esthetic and strong restorations for excesively damaged crownns. Using fiber reinforced materials as a core structure may strengthen the restoration. Prefabric core build-ups maket he manipulation easier with a good adaptation.

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