Intraradicular Rehabilitation - A Restorative Solution To A Non Ideal Root- A Case Report

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Abstract

Aesthetics plays an important role on psychological perspective of an individual. The fracture of an anterior tooth is a common occurrence in young individuals and requires rehabilitation of the affected tooth.
This article presents a clinical case of a patient aged 16 years with a structurally compromised, fractured anterior tooth with a short root and open apex reinforced intraradicularly with flowable composite and a light transmitting glass fibre post.

KEY WORDS: Trauma, Glass fiber post, Flowable composite, Resin cement

Introduction

Trauma to dentition is most common in the age group of 9-10 years (1). During this period, the roots are still in the process of maturing hence there is less intraradicular dentinal thickness and the tooth and root are more prone to fracture. Etiology varies considerably ranging from mild blow, fall, automobile accident, or accident during sports. The most common fracture site for immature teeth occurs along the cemento-enamel junction. Restoration of such teeth to reestablish a radiant and confident smile is a challenging task to the clinicians especially for a tooth with minimal coronal tooth structure and a wide root canal.

The choice of Posts has evolved from very rigid material to a material that closely resembles the properties of dentin, so as to produce a mechanically homogeneous unit and result in reduction of stresses in the root structure. There is a strong co-relation between the elastic modulus of the posts and the resulting stress and root fractures. Glass fibre post has modulus of elasticity and biomechanical behavior which is nearly identical to that of dentine (2) and is reported to cause less stress in the tooth and fewer root fractures, while supporting a greater load, not requiring measurements to be as precise when sizing posts and furthermore, the tooth's root is not affected in the event of fracture, unlike metallic posts.

The objective of this case report is to describe a step by step approach of rehabilitating a fractured anterior tooth with a non ideal root using flowable composite resin and Glass fibre post in combination with clinical crown lengthening procedure.

Case report

A 16 year old female patient reported to the Department of Conservative Dentistry and Endodontics, V.S Dental College and Hospital, Bengaluru with a complaint of

fractured maxillary right and left central incisors with history of trauma 6-7 years back. Patient had no complaint of pain, sensitivity or any incidence of intra or extra oral swelling.

On clinical examination there was a Ellis class II fracture on maxillary right central incisor and Ellis class III fracture on maxillary left central incisor with a pulp polyp protruding out of the coronal cavity and the tooth was in cross bite.(Fig 1,)

Fig No:1 Pre-Operative Photograph

On radiographic examination, the maxillary right central incisor had fracture localized to dentin without involving pulp and maxillary left central incisor had wide pulp chamber and root canal with less dentinal thickness ,short root with an open apex with periapical changes, and without any evidence of root fracture and resorption (fig 2)

Fig No:2 Pre-Operative Intra-Oral Radiograph

Treatment procedure

At first visit the pulp polyp was removed and gingivectomy was carried out to create ferrule in the tooth. Diode Laser (Sirona, 910nm) (Fig 3) was used to perform the above procedure. Subsequently working length was established (16 mm) and root canal was cleaned and shaped with circumferential filing motion using H-files to shave the infected canal walls. The main purpose was debridement of the canal without thinning down the delicate dentinal walls further. An apical plug of 3 mm was placed using Mineral Trioxide Aggregate (MTA).(Fig No:4)

Fig No:3 Diode Laser Being Used For Pulpectomy.

Fig no:4 Apexification with MTA

During the second visit canal was obturated using Thermoplasticized gutta-percha.

At the third visit the post space of 10 mm was prepared using peeso reamer leaving 4mm of apical gutta-percha. The canal was etched with 37% phosphoric acid (Ultra Etch. Dentsply) for 15 seconds ,thoroughly rinsed with water and gently air dried followed by application of dual cure adhesive (Prime and bond NT mixed with self cure activator, Dentsply) for 20 seconds & light cured for 40 seconds to enhance the bond strength to root dentin.

This was followed by injection of flowable composite resin (Star lite) into the canal along the light transmitting post which was centered for adequate reinforcement. These light transmitting posts allow light to pass through and completely polymerize the composite resin along the entire length of the root space(fig5). Dual cure resin cement (Smart CemII, Dentsply) was then injected into the ideal post space created (fig 6) which was then followed by the placement of a glass fiber post (Radix) and then cured for 40sec(7).(Fig 7)

Fig No:5 Intra-Radicular Reinforcement With Composite Resin

Fig No: 6 Post Space Preparation For Glassfibre Post

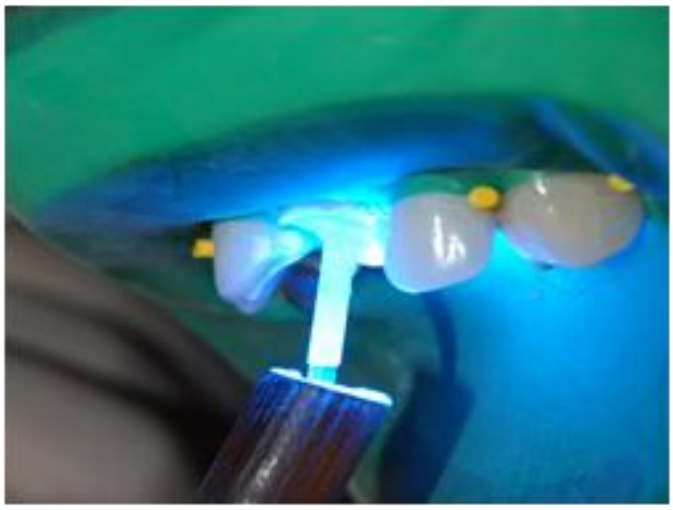

Fig No:7 Placement Of Fiberpost And Light Curing

The excess post was trimmed and the core was built with a nano-hybrid composite resin (Tetric Ceram)(fig.8). The Tooth was then prepared to receive a metal ceramic crown. Gingival retraction was followed by a definitive impression with Polyvinyl Siloxane Impression material.Fractured maxillary right central incisor was restored with composite resin and Metal ceramic crown was fabricated and cemented in place using type I Glass Ionomer Cement (fig.9).

Fig No:8 Core Buildup

Fig No:9 Post-Operative Photograph

Discussion

When the tooth structure is extensively lost a post placed in the tooth remains susceptible to failure without the crown encircling the tooth apical to core. This ferule effect around the tooth protects it from fracture by the post.

In the present case a Diode Laser was used to create a Ferrule in initial phase of endodontic therapy and to have a greater precision with small zone of necrosis after tissue recon touring with good predictability of margins, relatively bloodless surgical field and less post surgical pain. Therefore, Diode laser is a great adjunct to create adequate ferrule effect during crown lengthening procedure.(3)

MTA was introduced into dentistry as a root end filling material. It reacts with tissue fluids to form a hard apical barrier. As a result this material is promising for one visit apexification(4), especially with immature necrotic tooth. With the MTA apical plug technique, a one-step obturation can be performed. So the advantages of MTA as an Apical barrier was to provide(5 ,6,7)

1. Immediate apical seal
2. Induced apical hard tissue formation
3. Less potential to weaken tooth structure compared to Ca (OH)2.

The functional and para-functional forces that occur within the mouth result in extremely complex structural response by the oral tissues. This makes oral rehabilitation an inherently challenging task (8).

The important criteria for post core design include: i) to provide sufficient retention to the core and ii) to distribute functional stresses uniformly through-out the tooth-root. A variety of post systems exist for the restoration of endodontically treated teeth that have inadequate remaining tooth structure. The high success rate for modern day endodontics has resulted in an increased demand for clinically convenient post and core systems to help restore lost tooth structure.

In 2004, Anil Kishen *et al.* suggested that the structure of inner dentin, which surrounds the root canal is less mineralized and has more collagen, hence posses low modulus of elasticity. The conservation of the inner dentin is crucial to offer toughness or fracture resistance to the tooth structure. Undue loss or removal of inner dentin would compromise the toughness criteria in dentin structure, which in turn would predispose such a tooth to catastrophic fracture.

Flared canals, whether resulting from carious extension, pulpal pathology or endodontic access, present a restorative management problem. Intra-radicular rehabilitation, before post cementation or post fabrication increases the chance for clinical success of the tooth(9) . It is important that the remaining dentin structure has sufficient strength to support the post-core-crown complex that will eventually restore the tooth in form and function.

Lack of dentin support at the coronal end of the root canal also poses a problem to the restorative dentist. To restore the lost dentin, in 1987, Lui *et al.* advocated the use of composite resin as a lining of the root canal surface to reinforce the weakened canal walls. Use of resins for the rehabilitation of a root canal is also supported by Saupe *et al.* in 1996.

The modulus of elasticity of composite resin approaches that of dentin. The replacement and reinforcement of intra-radicular tooth structure with a material that is elastically compatible with dentin is far better than morphologic dowel(10), which has higher modulus of elasticity and hence higher potential to transfer and concentrate applied stresses to the surrounding compromised root structure.

MODULUS OF ELASTICITY OF DIFFERENT MATERIALS

Dentin	18.6 Gpa
Resin composite	17 Gpa
Resin cement	8 Gpa
Glass fibre post	40 Gpa
Zircon post	230 Gpa
Cast metal post	170 Gpa

FEM STRESS AT DENTIN POST INTERFACE

Steel post	7.51 Mpa
Carbon fibre post	3.25 Mpa
Glass fibre post	2.22 Mpa

According to Neagley 8 mm is the minimum length of post required. The post length used in the present case was 9 mm and placed well above the alveolar crest of the bone to prevent the concentration of stresses. So, the rationale for use of all these materials is well established. Hence, even a mutilated tooth need not be extracted and clinical success of such teeth is on rise.

CONCLUSION

Multidisciplinary management of a structurally weakened root through conservative approach by reinforcement with Flowable liner and Glassfibre post can be a simple and efficient procedure for the treatment of immature anterior traumatized teeth with excellent esthetic & functional Results. Such teeth restored with this technique best serve the needs of the patients.

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