CASE REPORTS

RESTORATION OF MUTILATED TEETH USING ALTERNATE AESTHETIC POST SYSTEMS

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Abstract:
In this era of material science advancement, newer techniques and materials have been formulated for the rehabilitation of grossly destructed teeth. These have helped overcome the disadvantages of the traditional methods. Two clinical case reports of restoring form and function using these novel techniques and materials are presented here. In the first case an anatomic post was fabricated in a wide and flared root canal. In the second case a novel material from GC, Ever Stick Post was used to reinforce the tooth and adapt to the anatomy of the canal. Both these techniques can be used as alternatives to conventional methods of rehabilitation.

INTRODUCTION:
The rehabilitation of teeth with a history of trauma or extensive dental caries poses a challenge to the clinician. The presence of reduced circumferential dentin, immature root canals, loss of moisture and coronal destruction from dental caries weaken the tooth structure, making it susceptible to fracture under normal masticatory forces. Such teeth may require an additional system of reinforcement to aid in retention of the core, thereby re-establishing the tooth to its original aesthetics and function.

Traditional restorative techniques incorporated the use of materials with different physical and mechanical properties which resulted in multiple weak interfaces. These interfaces served as areas of stress concentration thereby becoming more prone to failure. The need to eliminate these weak interfaces led to the evolution of the monoblock concept. The term monoblock, which means a mechanically homogenous unit, was first introduced in 1902 by Dr. Pierre Robin in Orthodontics.

Pontius and Hutter suggested two methods; Conventional and intraradicular reinforcement for the restoration of weakened root canals. The use of cast metal posts may cause wedging forces at the already thin and weakened portions of the roots which may ultimately lead to catastrophic failures. To improve prognosis in such cases, a technique called as the “Reinforcement Technique” was introduced which internally strengthened the thin dentinal walls.

Therefore, restorative materials that had modulus of elasticity similar to that of dentin were employed.

The similarity in elastic modulus of the restorative materials was perceived to be advantageous for improving the performance of restorations by forming a monoblock.

Two cases reports of managing anterior teeth with flared root canals using alternative methods of rehabilitation are presented here.
Table 1: Modulus of elasticity of different materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Modulus of elasticity</th>
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<tbody>
<tr>
<td>Dentin</td>
<td>14 GPa</td>
</tr>
<tr>
<td>Fibre post</td>
<td>16 to 40 GPa</td>
</tr>
<tr>
<td>Resin cement</td>
<td>6.8 to 10.8 GPa</td>
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<tr>
<td>Composite</td>
<td>5.7 to 25 GPa</td>
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Case Report 1: Anatomic Post

A 24-year-old male patient reported to Faculty of Dental Sciences, MS Ramaiah University of Applied Sciences; Bangalore with the chief complaint of a decayed and discoloured upper anterior tooth. The patient had visited a private clinic for the same complaint where the practicing dentist had initiated root canal treatment. However, the treatment was left incomplete.

On clinical examination, a temporary restoration was found in relation to 11. An intra-oral periapical radiograph revealed the presence of a wide canal with thin dentinal walls, with no periapical pathosis. On removing the temporary restoration from the access cavity, a very large canal space was observed (Fig.1). As the canal size was very large, an alternative treatment modality had to be considered for rehabilitation of the tooth. A #90 K file was the 1st file that bound apically. Minimal chemical-mechanical preparation was done until clean dentinal shavings were obtained. In the following appointment, an apical plug of 5mm of thermoplasticized gutta percha (Fig.2) was placed.

A 1.5 mm diameter glass fiber post (Reforpost, Angelus, Londrina, PR, Brazil) was selected for the fabrication of an anatomic post. Conditioner and bonding agent (Paracore, Coltene/Whaledent Inc., Cuyahoga Falls, OH, USA) were applied to the glass fiber post prior to addition of the composite material.

Flowable resin composite (Filtek Z350 XT, 3M ESPE, Gulf) was placed on the apical third of the glass fiber post and placed into the canal to facilitate adaptation to the canal wall. An LED source was used to cure the glass fiber post-composite assembly. The glass fiber post was withdrawn and the composite was again cured outside the canal. Another increment of composite was added to the post-composite assembly in the middle third and placed into the canal. The glass fiber post was thus incrementally covered with flowable resin composite apicocoronally. This process was repeated until close adaptation to the internal anatomy of the root canal was achieved (Fig.3).

The root canal was then irrigated with 17% EDTA to eliminate the smear layer. An intermediate rinse with distilled water was followed by final irrigation with 2% CHX. The canal was dried with the use of paper...
Conditioner and bonding agent (ParaCore, Coltene/Whaledent Inc., Cuyahoga Falls, OH, USA) was applied to the canal walls. The resin cement (ParaCore, Coltene/Whaledent Inc., Cuyahoga Falls, OH, USA) was dispensed into the canal and applied on to the anatomic post. The anatomic post was then cemented in the canal. The core buildup was done using dual cure resin (ParaCore, Coltene/Whaledent Inc., Cuyahoga Falls, OH, USA) core build up material (Fig. 4).

The patient also had an unaesthetic crown in relation to 12 and wanted replacement with the same. Therefore, tooth preparation to receive all-ceramic crowns was done in relation to 11 and 12 (Fig. 5). The fabricated all ceramic crowns were then cemented with resin cement (Variolink, Ivoclar Vivadent AG, Benderer Str. 2, FL-9494 Schaan, Liechtenstein).

Case report 2: GC post
A 36 year old male patient reported to the department of Conservative Dentistry and Endodontics, Faculty of Dental Sciences, Bangalore with the chief complaint of discolored upper front tooth and midline spacing. Patient gave a history of fall at the age of 14 years for which he did not seek any treatment.

On clinical examination 21 showed brownish-grey discoloration with Elli’s Class III fracture. To confirm the clinical findings, an intra oral periapical radiograph was taken which revealed a large canal space with incomplete root formation and an immature apex in relation to 21 (Fig 6). After thorough clinical and radiographic examination a detailed treatment plan was chalked out and discussed with the patient and the consent obtained.

In the first visit, an access cavity was prepared and a straight line access was obtained. Next, the necrosed pulp was extirpated, working length established and complete chemo-mechanical preparation and debridement of canal was done upto 60 K file along with copious irrigation with normal saline and Asep-RC (2 % Chlorhexidine). In the next appointment, Pro root MTA (Dentsply Tulsa Dental Specialties, Dentsply International, Inc., 608 Rolling Hills Drive, Johnson City, TN 37604) was mixed with normal saline and this mixture was placed into the canal and positioned as a 5mm MTA apical plug (Fig 7). The mixture was adapted to the canal walls using Schilder’s posterior plugger with a size proportional to the apical gauge and confirmed using periapical radiograph. A cotton pellet wet with sterile water was then placed in the pulp chamber and the access cavity temporized with IRM (The Caulk Division, Dentsply International Inc., Milford, DE 19963-0359). As the canal size was large it was decided to use GC ever
Stick Post system for its rehabilitation (Fig 8). GC ever stick post was used as an alternative method of reinforcing and retaining the core. The canal was rinsed with saline and dried carefully using paper points. The depth of the prepared canal and the estimated height of the coronal structure to be built-up were measured. With the help of sharp scissors, the EverStick fiber was cut to a suitable length and the posts were manipulated with tweezers to adapt to the canal walls. Two posts were needed in this case as the root canal space available was too large. To cement the EverStick fiber within canal, low viscosity dual curing cement (Paracore, Coletene/Whaledent Inc., Cuyahoga Falls, OH, USA) was used. The canal was filled with the cement using an intraoral tip, and then slowly the fiber was inserted into the canal. The coronal part of the post fiber was shaped as a fan or wing while it was still soft to retain the core (Fig 9). Any excess cement, if present was removed at this point. The EverStick fibre and the cement were light cured for 40 seconds using an LED source (Elca Technologies S.r.l, socio unico - Via Gambellara 43/C Imola - Bo - Italy). When the post and cement were cured, the core was built using composite resin.

Since, the patient was concerned about his anterior esthetics he was given the choice of closing diastema with a veneer in relation to 11 and an all ceramic crown in relation to 21. Therefore, tooth preparation was done in relation to 11 and 21 (Fig 10) and the veneer and crown cemented (Fig 11) with resin cement (Variolink, Ivoclar Vivadent AG, Benderer Str.2, FL-9494 Schaan, Liechtenstein).
Discussion:

Restoring teeth with flared canals and thin dentinal walls is a challenge for any clinician. Due to absence of adequate radicular dentin the tooth experiences a higher risk of biomechanical failure.

In the past, cast metal post-and-core was widely accepted as a treatment modality for restoring teeth with inadequate coronal tooth structure. However, due to the multiple appointments and additional laboratory procedures required as well as issues like the high modulus of elasticity of the cast metal (203.6 GPa) there was a need for alternative restorative technique and materials.

In a Finite element analysis study done by Pegoretti et al7 it was found that stress concentrations in teeth restored with cast post and core were greatest at the post dentin interface. On the other hand the glass fiber post showed lower stresses in the root canal because of its similar stiffness to dentin. Therefore, they concluded that ‘except for the force concentration at the cervical margin, the glass fibre composite post induces a stress field quite similar to that of the natural tooth.’

The basis of selecting a particular type of post is dependent on the fracture resistance and retention of the post in the restored tooth. Multiple factors need to be considered when selecting a post system which includes the amount of remaining tooth structure, periodontal status, aesthetic demands of the patient, arch position and occlusal relationship. Morphology, length and width of the tooth root also need to be kept in mind. In case report No.1, the tooth had a canal which oval and flared with thin radicular dentin. Any more instrumentation to create a round canal for a fibre post would lead to further weakening of the root structure. Placement of a conventional fiber post into such a canal would require a thick layer of luting cement to fill up the spaces between the loosely fitting post and the canal walls. However, the C-factor in such canals has been found to be extremely high resulting in increased polymerization shrinkage which can lead to adhesive failure. Tay FR et al9 in their study titled “Geometric Factors affecting Dentin Bonding in root canals: A theoretical model approach” concluded that as the thickness of adhesive is reduced, the volumetric shrinkage is reduced which results in reduction of shrinkage stresses.

Therefore, in this case the fabrication of an anatomic post was decided upon to decrease the resin cement thickness; making it less susceptible to the unfavourable effects of polymerization shrinkage. In addition the lower modulus of elasticity of the post prevents the root fracture by reducing the forces that are transferred to the root10.

In case report No. 2, the upper left central incisor also presented with a wide and flared root canal with an immature apex. Creating an apical barrier and rehabilitation of the tooth with a material which has modulus of elasticity comparable to dentin was the objective of our treatment.

MTA was the choice of barrier material in order to achieve apexification prior to rehabilitation of the tooth. MTA apical barrier technique has many advantages over the conventional apexification procedures. It overcomes the shortcomings of conventional techniques namely defective barrier formation and the need for multiple visits and long follow up. Additionally, MTA induces a constant formation of cementum with a highly integral periradicular structure11,12.

GC has launched a novel tooth rehabilitation material marketed as EverStick POST which is a soft, flexible and unpolymerized glass fibre post. It can be individually adapted to the shape of the root canal before light-curing while offering high strength after light curing. EverStick Post is made up of the patented interpenetrating network (IPN) technology which consists of bundles of approximately 4000 individually silanated E-glass fibers that are fully impregnated with resin. Adhesive and micromechanical bonding to both composite cement and core composite is attributed to its IPN structure13. This helps in even distribution of occlusal stresses on the root structure. It is also able to mimic the anatomy of the canal, thereby reducing the risk for root fracture tremendously.

Conclusion:

In the long term, catastrophic failures of teeth rehabilitated with cast post and core systems have pushed clinicians to search for alternative restorative materials and techniques. Materials which have modulus of elasticity comparable to dentin enable the equitable distribution of forces along the root canal walls. The glass fiber post- composite assembly known as the anatomic post and EverStick Post have provided clinicians with novel alternative modes to rehabilitate grossly mutilated teeth.

References:


2. Tay FR, Pashley DH. Monoblocks in Root Canals: A Hypothetical or a Tangible Goal. J


