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A biomimetic rehabilitation of fractured immature anterior tooth: A case report

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Abstract
The long term success of an endodontically treated teeth is the elimination of micro-organisms and creation of an apical seal. Trauma to the developing dentition can lead to immature apices along with pulpal necrosis. Several materials have proved its worth as a material for apexification however consideration should also be given to the reinforcement of the already weakened tooth. This case report highlights the apexification procedure followed by post- retained restoration.

Keywords: trauma, MTA, fibre post, apexification

Introduction
Traumatic injuries to the dentition is quite a common occurrence which ranges from 15-49% [1]. It is more commonly seen in the primary dentition in comparison to the adult and primarily involves the maxillary anteriors [2]. Various types of injuries occur, depending on the nature, resiliency and impact of the injury, which ranges from concussion, subluxation, intrusion, extrusion, luxation and avulsion. Apart from these, coronal fractures are quite common and share a good prognosis if treated at earlier stages [3].
Trauma to the dentition during its developing stages can lead to loss of vitality and incomplete root development with an open apex, making endodontic procedure difficult [4]. An ideal treatment modality would be regeneration of the pulp dentin complex allowing continued root canal maturation in its length and thickness and restoration of its vitality. However, it is heavily dependent on the age factor, stage of root development and the long-time duration involved. Since the tooth are not fully developed, they are highly prone to cracks and fracture [5].
An alternative treatment modality includes apexification using MTA cement followed by reinforcement of the weakened tooth structure with a post system exhibiting similar modulus of elasticity to the radicular dentin [6].
Fibre post present similar modulus of elasticity and resiliency to radicular dentin, hence preventing any untoward stresses to the already weakened tooth structure [7]. MTA has been proven to be highly successful material to be used in the apexification procedure due to its excellent biocompatibility and adequate sealing ability [8].
This case report highlights the rehabilitation of an immature non-vital teeth using MTA and use of the Fibre post to reinforce the weakened tooth structure, followed by full coverage restoration by a lithium disilicate crown.

Case report
A 23 year old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of discoloured tooth in the upper front tooth region. The patient gave a history of no pain. On clinical examination, Ellis class IV fracture was seen in 11 along with bluish black discoloration involving the coronal aspect. Radiographic examination showed incisal radiolucency involving the pulpal region and open apex in the radicular region. On pulpal sensibility testing, no response was noted on the concerned tooth as compared to the adjacent and contralateral tooth. No tenderness on percussion and palpation was noted. A diagnosis of pulpal necrosis was made and a treatment protocol of root canal treatment, followed by apexification using MTA and fiber post retained full coverage

restoration was decided.

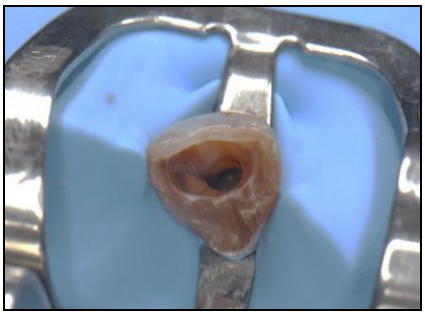
Oral prophylaxis was done and pre-operative radiographs were taken and shade selection of A2 was done using the Vita Classic Shade Guide. Rubber dam isolation using a thick sheet was done and access opening was initiated. On locating the canal orifice, the chamber was enlarged to remove the coronal pulpal chamber remnants. Working length was determined and minimal instruments was done aided with copious irrigation using 2.5% sodium hypochlorite and 17% EDTA using Endo Activator. An intracanal medicament of calcium hydroxide was placed and kept for a week followed by temporary restoration.

After a week, the temporary material was removed and the canal was flushed with irrigant to removal any residual medicaments. The canals were dried using paper points and a 4mm thickness of MTA was placed at the apical region followed by placement of a moist cotton over it for proper setting. After 4 hours, the hardness of the MTA cement was determined and verified radiographically. An appropriate sized fibre post was selected and fitted and on radiographic configuration, was cemented in the tooth using resin luting cement.

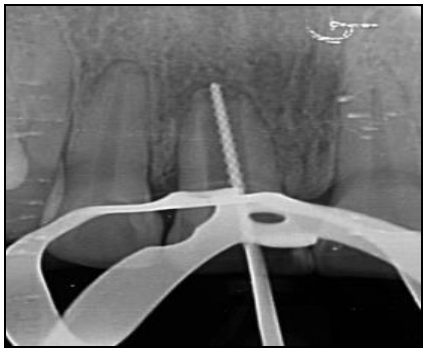
Core build up was done using composite restorative material and tooth preparation was initiated. Impression was made using polyvinyl silicone impression material using the putty wash technique and was sent to the laboratory for fabrication of the lithium disilicate crown. On receiving the prosthesis, try in verification was done. The prosthesis was treated with hydrofluoric acid and silane application whereas the tooth was etched with 37% phosphoric acid and bonding agent application. The prosthesis was cemented using resin cement and was verified post-operatively via radiograph.

Pre-operative radiograph

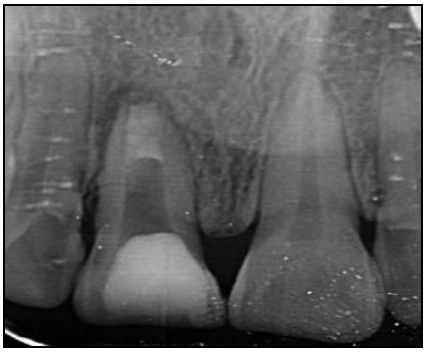
Rubber Dam isolation



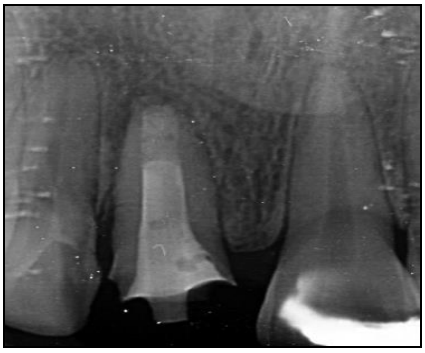
Access opening



Working length

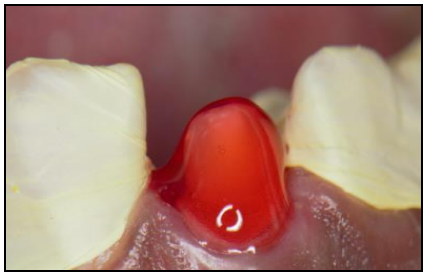


MTA placement



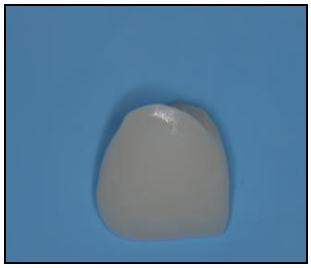
Fibre post placement

Tooth preparation

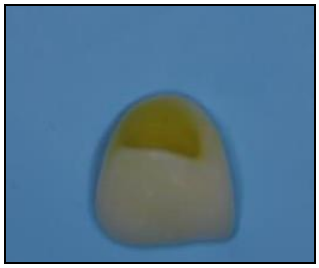


Etchant application

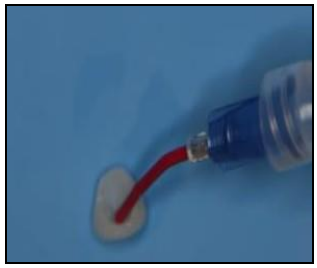
Bonding agent application



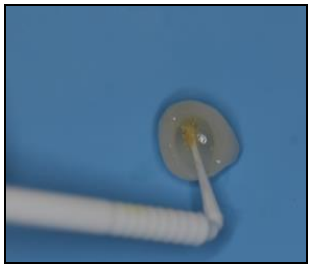
Lithium Disilicate crown



Hydrofluoric acid application



Silane application



Bonding agent application

Post-Crown cementation

Discussion

Maxillary central incisors are the most commonly injured tooth in the dentition due to its position in the arch and an increased predisposition in the cases of contact sports or patients exhibiting increased overjet [9]. Traumatic injuries involving the coronal aspect of the tooth renders it more susceptible to the bacterial invasion and makes it more non-vital and necrotic [10].

Regeneration of the pulp-dentin complex along with the restoration of the tooth vitality is highly desirable treatment outcome in cases of necrotic teeth with an immature apex [11]. However, it is restricted by age consideration and normally not feasible, due to prolonged treatment time involved. Use of PRF and PRP has fastened the treatment time in regenerative cases, however it still continued to be harbours a poor patient acceptance and response [12].

A major challenge in the restoration of an immature apex in the absence of an apical constriction which would lead to extrusion of the filling material. Thus, a barrier would be needed as to prevent or limit the level of radicular filling and provide an adequate and favourable apical seal [13].

Apexification is a treatment modality of choice to induce the formation of a calcified barrier in the root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp [14]. MTA has become the choice of material for apexification due to its excellent biocompatibility, osteoconductive properties, adequate sealing ability and anti-microbial effects. MTA has been shown to induce formation of cementum and stimulate periradicular tissue repair. However it also present several shortcomings such as prolonged setting time, difficult handling characteristics, discoloration tendency and its high cost [15, 16]. Alternative material for apexification would be Biodentine and calcium sulphate cement which provides the advantage of shorter setting time, easier handling characteristics and inexpensive as compared to MTA [17, 18, 19, 20].

Reinforcement of the weakened tooth is necessary as they are more prone to fractures. Custom cast post could be given due to its superior adaptation to the radicular canal walls. However, it gives risks to wedging forces to post-core tooth unit invariably leading to fracture and also provides and unesthetic display [21]. Recently fibre posts are considered as a viable esthetic alternative and they also have similar modulus of elasticity (20-25 GPa) to that of radicular dentin [22]. Resin cements used to bond the post to the radicular dentin also serve to reinforce the tooth structure. Fibre post also serve as an excellent adaptability to composite resin restorative material for core build up to facilitate post endodontic restoration [23]. Thus, proper adaptation of MTA and fibre post system and timely placement of full coverage restoration prolongs the prognosis of the tooth in the dental arch.

Conclusion

A careful and early treatment approach is needed to safeguard the prognosis of the traumatised teeth. Use of a biocompatible material like MTA followed by fibre post retained restoration reinforced the traumatised tooth and increases the fracture resistance and esthetics of the tooth.

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