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Revascularization or Apexification: Treatment of Choice in Non Vital Teeth- A Case Report of 2 Teeth

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Case Study

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ABSTRACT

Alternatives like apexification or revascularization can be performed for the treatment of non vital teeth in young permanent teeth. Apexification with Mineral trioxide aggregate (MTA) is the best alternative but it has the limitation of high cost and non-reinforcement of root canal dentin. So a new material Biodentine bioactive calcium silicate-based cement has been recently launched in the dental market as a 'dentin substitute' which claims improvements of some of the properties such as physical qualities and handling. Nowadays regeneration of tissues is the emerging and exciting field in the health sciences rather than replacement with artificial substitutes. Pulp revascularization depends on the ability of residual pulp and apical and periodontal stem cells to differentiate. However, both the methods i.e., apexification and revascularization are effective regarding the narrowing of the apical foramen of an immature tooth.

Keywords: Apexification; non vital teeth; revascularization.

1. INTRODUCTION

Trauma or caries can result in pulp necrosis in young permanent teeth and will eventually cause cessation of root apex closure and ultimately root maturation that will lead to fragile canal walls and root apex open. Under these conditions, instrumentation of the root canal will not be able to achieve the adequate apical stop [1].

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Apexification with calcium hydroxide has limitations like [2]. achieving barrier formation; and, strengthening or reinforcing of the thin fragile blunderbuss canals is not achieved and long term therapy will eventually make tooth brittle because of hygroscopic and proteolytic properties of calcium hydroxide [3]. Barrier formation with calcium hydroxide is often porous and not continuous [4]. However, Mineral trioxide aggregate (MTA) has also been used to provide an artificial barrier but the limitations of non-reinforcement of root canal dentin and high cost still remains [5]. So a new material biodentine bioactive calcium silicate-based cement has been recently launched in the dental market as a 'dentin substitute' which claims improvements of some of the properties such as physical qualities and handling [6].

Recently pulp regenerative process has been shown to be effective in non vital, infected immature teeth. Terms like revascularization, revitalization or maturogenesis has been used by the authors for the pulp regenerative process [7]. Periodontal stem cells plays an important role in pulp revascularization [8]. A highly vascularized and a conjunctive rich living tissue is generated by these cells and is able to colonize the available pulp space. That will lead to the formation of odontoblasts by the differentiation of apical stem cells and induce an apposition of hard tissue [9].

Both apexification and revascularization are effective methods for narrowing of the apical foramen of animmature tooth. However, revascularization of the pulp differs from the apexification in the aspect that it allows root walls growth and thickening and closure of an open apex [10]. This case report describes the treatment of two immature maxillary central incisors by conventional apexification method and pulp revascularization process.

2. CASE REPORT

A twelve year old female patient reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of broken teeth in upper front region (Fig. 1).

Patient revealed the history of trauma 3 years back and medical history was non contributory. Intraoral radiographs showed immature apices associated with both maxillary central incisors (Fig. 2).

Root fracture was not evident. Thin dentinal walls with wide root canals, slight flaring at apical end and associated periapical radiolucency was seen. Thermal tests and response to electric pulp testing (Vitality Scanner, USA) were indicative of irreversible pulp damage. Treatment decided was to perform apexification with Biodentine followed by gutta percha obturation in left maxillary central incisor, and revascularization procedures in right maxillary central incisor.

Fig. 1. Intra oral preoperative view

Fig. 2. Intra oral radiograph of upper central incisors showing wide root canals and immature apices

Local anesthesia of 2% lidocaine with 1:100,000 epinephrine was given to the patient. Rubber dam placement was done, and a conventional endodontic access opening was made with help of Endo Access burn 0.1 (Dentsply Maillefer, Ballaigues, Switzerland). Enlargement of the conventional triangular access cavity corresponding to the large pulp cavity was done with the help of slow speed diamond bur no.3 (Dentsply Maillefer, Ballaigues, Switzerland). After gaining access, the root canals were irrigated and gently instrumented to confirm that there was no spontaneous discharge from any root canal. The canals were copiously irrigated with 5.25% sodium hypochlorite solution (Azure laboratories, Kochi, India) and then with normal saline solution. Estimation of working length was done with the help of intra-oral peri-apical radiographs. Sterile #60 K files were used for the minimal instrumentation of the root canal space so as to prevent further weakening of thin fragile dentinal walls. In both centralincisors, a triple antibiotic paste containing minocycline, ciprofloxacin and metronidazole was placed in the root canal. The access caity was sealed with GIC and the patient was recalled after 1 week.

After 1 week, distilled water and 5.25% sodium hypochlorite solution were used to flush the intracanal medicament [11].

The right central incisor was prepared for revascularization procedure on the same day and the periapical area was punctured thorough the root canal with 31 mm #15 K file. Sharp short stokes were intentionally used to induce bleeding inside the canal from periapical issues. When fresh bleeding was seen in the root canal system, blood clot was allowed to form by tightly pacing the wet cotton pellet in the coronal third of the canal. After 10 minutes, cotton pellet was removed and coronal third was sealed with white MTA (ProRoot, Dentsply/Tulsa Dental, USA) which was initially carried to the coronal 1/3 using a MTA carrier, and then compacted using wet cotton rolled on a sterile reamer to provide a radiographic extension of 4 mm into the canal. Squeeze dry cotton pellet was placed in the chamber and access cavity was sealed with a temporary restorative material (Cavit-G, 3M ESPE, USA). After 48 hours, temporary restoration and dry cotton was removed from the chamber and cavity was restored with a glass ionomer base (3M ESPE Ketac Molar) and light cure composite resin (*3M ESPE Filtek Z350* XT) (Fig. 3).

In the left central incisor appropiate working length was determined with the help of K file (Fig. 4).

Biodentine (Septodont) was mixed according to the manufacturer's instructions.It was carried into the canal of the left central incisor with the help of an amalgam carrier and then delicately pushed towards the apex with a root-canal

plugger. Several increments of Biodentine were required to form a plug of adequate thickness of 4 mm. Following the placement of Biodentine, butt-end of a wet paper point was used to clear out any excess material from the root canal walls. After 12 minutes, a root canal plugger was used to check the hardness of the Biodentine to confirm its set [11]. The root canal was then conventionally obturated with gutta percha using lateral compaction technique with Sealapex (Kerr, Sybron, USA) (Fig. 5).

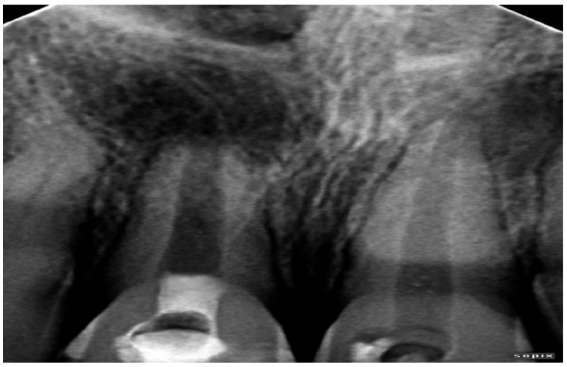

Fig. 3. Revascularization done in right central incisor

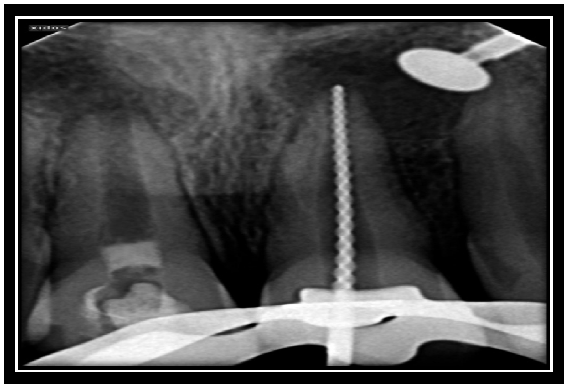

Fig. 4. Working length determination of left central incisor

Fig. 5. Apexification done in left central incisor

Fig. 6. Postoperative restoration

The tooth was then restored with abonded composite resin Brilliant NG (Coltene/ Whaledent, Switzerland) (Fig. 6).

The patient was then recalled after 3 months, 6 months and 12 months respectively for clinical and radiological evaluation (Fig. 7).

Follow-up radiographs showed appreciable thickening of dentinal walls of the right central incisor in which pulp revascularization was done. The mesial dentinal wall, which was thin and incomplete in baseline radiographs had shown elongation and thickening and also root endclosure along with root elongation was seen (Fig. 7c). The periapical radiolucency was also not seen in subsequent follow-up radiographs [11].

3. DISCUSSION

During the last 200 years, many changes has been seen in the way of performing endodontic treatment. The standard protocol has undergone several modifications, more so because of increased demand from the patients for saving their teeth and advances in material science and innovative equipments. Bioceramics materials in endodontics can be considered as a magnanimous entity which has changed the prognosis of many cases which were once considered as next to impossible [6].

Tooth injury can have many clinical and radiographic manifestations like pulpal changes, periradicular inflammation, and incomplete development of root apex. Blunderbuss canals can be a great threat to an endodontist because thin dentinal walls are more prone to fracture. Now the management of open apex have multiple options such as apexification, apexogenesis, or revascularization technique [12].

In this case revascularization and apexification have been performed. Single visit apexification with Mineral Trioxide Aggregate (MTA) as an osteoconductive apical barrier has gained much popularity. Thickness and sealing ability of MTA apical plug have been mostly demonstrated as a successful performance [13].

Fig. 7a. 3 Months follow up

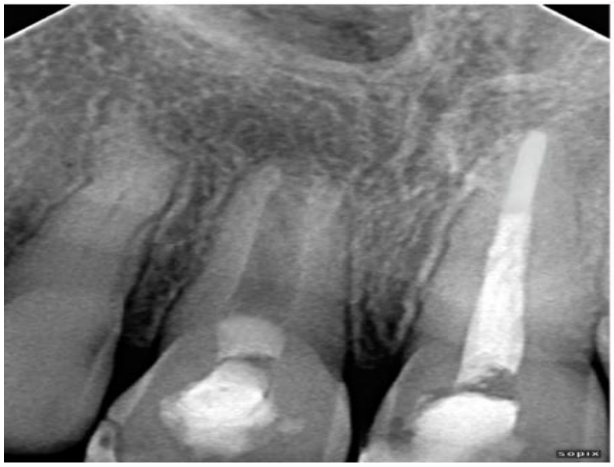

Fig. 7b. 6 Months followup showing healing of periapical radiolucency and increase in the length of mesial root wall in right central incisor

Fig. 7c. 12 Months follow up showing narrowing of apex and maturation of root with thickening and lengthening of dentinal walls in right central incisor

On the other hand, MTA has been demonstrated to have some disadvantages including a long discoloration, long setting time and high cost [14]. To overcome these problems, a new biomaterial named Biodentine, has been introduced in 2009 by Septodont with dentin-like mechanical properties. It has a good sealing ability and has shown favorable biologic response as a pulp capping agent. It also has good mechanical properties; its setting time is 12 minutes and does not cause discoloration [15]. So in this case report single visit apexification was performed with Biodentine [11].

Recently, it has been suggested that rather than apexification, regeneration is more appropriate because the entire root is allowed to regenerate in a non traumatized tooth [16]. Success of the pulp revascularization treatment depends on following three elements: disinfection of the root canal, presence of a scaffold (blood clot), and hermetic coronary seal [17]. Following three key elements are required for the generation of a functional tissue : growth factors, stem cells and a scaffold [18]. The formation of cementum bridges may be due to the use of MTA, which has osteoinductive capacity [19].

Regenerative endodontics, revasculariza-tion, or revitalization is therefore an effective and conservative option for necrotic immature teeth. It promotes further root, apical closure lengthening and thickening of root canal walls, so resolving the problem of susceptibility to fracture

that used to appear following apexification therapy. However, there are still too few large-scale clinical studies involving humans and more research is needed [20].

4. CONCLUSION

So according to our case report, we found that for necrotic immature young permanent teeth, the desirable alternative to apexification is the pulp revascularization or regeneration which showed both good short-term and long-term prognosis [21].

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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