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RESEARCH ARTICLE

MANAGEMENT OF OPEN APEX WITH REGENERATIVE ENDODONTIC THERAPY: CASE REPORT

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ABSTRACT

Trauma of developing teeth may lead to pulpal necrosis with subsequent arrestment of root development, making them more susceptible to fracture. Regenerative endodontic procedures induce maturogenesis in necrotic immature permanent teeth in order to promote continuation of root growth This case report describes the Revascularization of a Permanent Immature Maxillary left central incisor with Pulp Necrosis and asymptomatic apical periodontitis. Access opening was done & the canal was disinfected with copious irrigation using 5.25% NaOCl and triple antibiotic paste (Ciprofloxacin, Metronidazole, and Minocycline) as intracanal medicament. After the disinfection protocol is complete, it is followed by revascularization procedure. The apex was mechanically irritated to initiate bleeding into the canal to produce a blood clot to the level just below the level of cementoenamel junction. Mineral trioxide aggregate was placed over the blood clot followed by bonded resin restoration above it. The patient was recalled at follow-ups after seven days, three, six and nine months. No symptoms such as pain, inflammation, discomfort was observed during the review period and there was radiographic evidence of continuing thickness of dentinal walls.

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INTRODUCTION

The aim of endodontic treatment is to obtain a complete hermetic seal in the coronal and apical third and prevent re-infection. Anatomically most teeth have conical root canal that tapers towards the apical end (1). However, in case of younger children, any dental trauma damages the Hertwig's epithelial root sheath which leads to pulp necrosis and insufficient root development forming open apex. Management of non-vital young permanent teeth with open apex becomes a challenge to operator because the wide canal possesses difficulties in complete debridement and obturation. These canals always hold a risk of damage to the periapical tissues due to extrusion of the irrigating solution beyond the apex (2). Also, the thin dentinal walls and short roots which makes them more prone to fracture. Traditionally, the most popular method for managing such teeth has been by apexification by using calcium hydroxide or mineral trioxide aggregate (MTA). Apexification induces apical closure but does not thicken the root walls and there is lack of continued root development.

Revascularization is one such procedure that seeks to induce root formation of the root canal. It is a cell-free regenerative approach where the pulp tissue is repaired/regenerated by the stimulation, proliferation, migration, and differentiation of in situ endogenous cells (3). The regenerative cells are likely stem cells that migrated from the apical region into the root canal through the wide-open apex (4). The growth factors released from platelets and dentinal walls stimulate the migration and differentiation of the stem cells (5). The source of these stem cells is believed to be the apical papilla, which exists apical to the immature tooth (6). Root Canal Revascularization through blood clotting is a safe approach that has no risk of immune rejection or pathogen transmission. Proper disinfection of the canal and effective seal for the coronal access are also vital for the satisfactory results (7). Revascularization is the excellent option today to treat necrotic immature permanent teeth to have a better prognosis.
This report presents the case of a non-vital immature permanent central incisor in a 17-year-old boy which was treated by revascularization and describes the protocol followed for its management.

CASE REPORT

A 17-year-old male patient reported to the Department of Conservative Dentistry and Endodontics of Punjab Government Dental College & Hospital, Amritsar, with a chief complaint of discoloured tooth in the upper front region of the mouth. Upon taking further detailed history, it was reported that the patient had a history of trauma 8years back, after which the tooth began to discolour. Patient did not seek any treatment before for the same complaint.

On intra oral examination: An Ellis class 2 fracture of the left and right upper central incisors with discolouration was discovered as shown in Figure 1 and 2. Clinical examination revealed negative electrical pulp and cold tests for teeth 11 and 21, while adjacent teeth exhibited positive responses. There were no signs of infection or inflammation in the surrounding soft tissues, and the periodontal tissues appeared healthy, with normal periodontal probing measurements. However, Grade 2 mobility was present in relation with tooth 21. On percussion, the tenderness was negative for teeth 11 and 21.

Figure1. Pre-Operative Clinical Picture

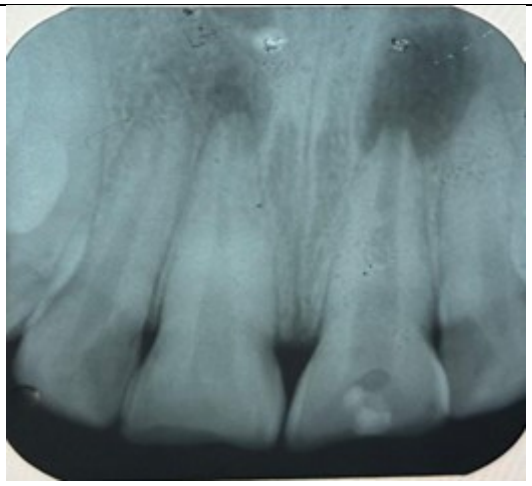

Figure 2. Pre- Operative Radiograph with21

Figure 3. Working Length Determination of 11 and 21 with #15k file

Figure 4.Working Length determination of 21 with #80 k file

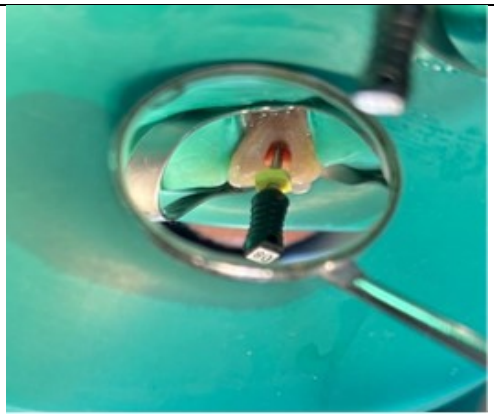

Figure 5. Bio- Mechanical Preparation till #80 k file

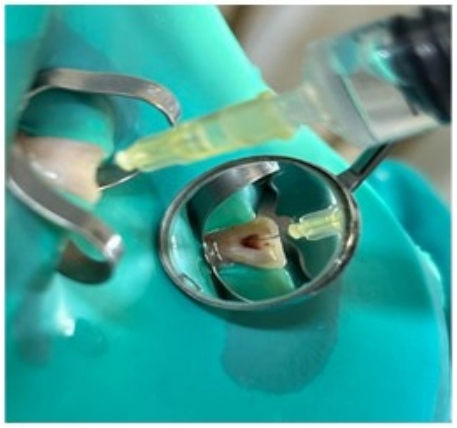

Figure 6. Irrigation with side vent needle

Figure 7. Side vent irrigating needle

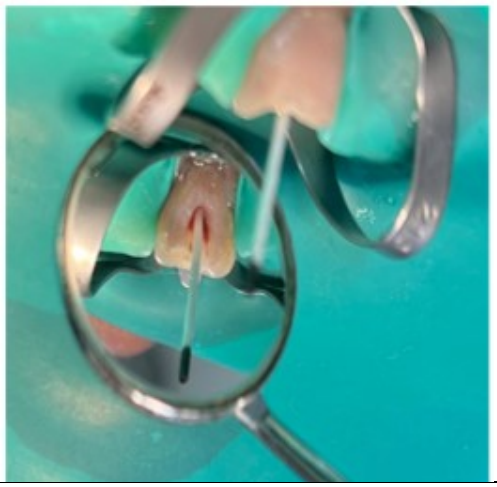

Figure 8. Drying with Paper points

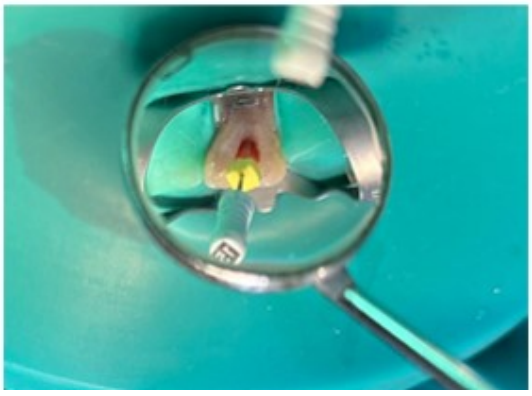

Figure 9. #15K File inserted 1-2 mm beyond apex

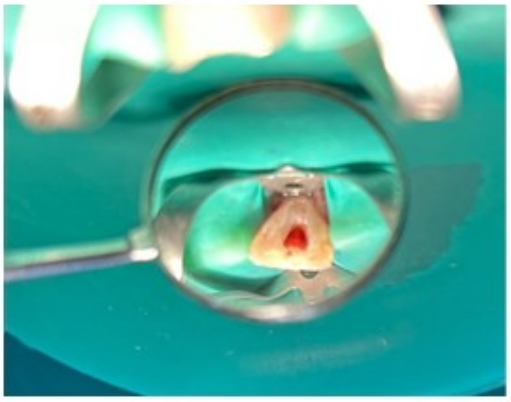

Figure10. Periapical bleeding induced

Figure 11.Clot formation after 1minute

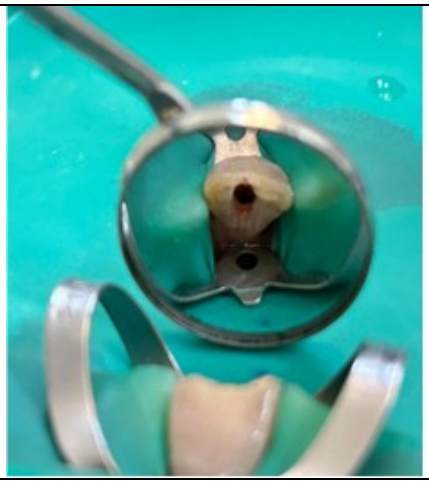

Figure12.Chamber is sealed with MTA

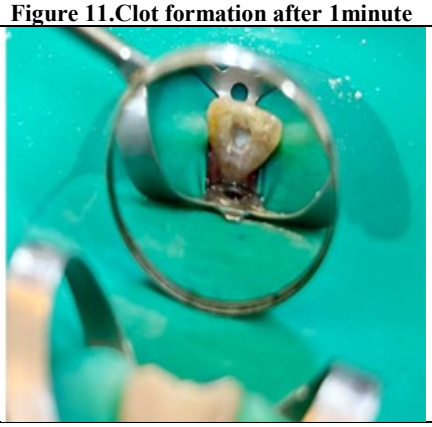

Figure 13.Chamber is sealed with MTA

Figure 14. .Post Operative Radiograph showing MTA placement in tooth 21.

A preoperative periapical radiograph revealed unique characteristics of tooth21, including a relatively short root, wide canal, and an abnormally flat-shaped apex in comparison to adjacent teeth.A distinct periapical radiolucency was also observed in relation with 11 and 21.The tooth was diagnosed with necrotic pulp and asymptomatic apical periodontitis. Taking into consideration the incomplete root development and nonvital status of the pulp, revascularization procedure was evaluated as a therapeutic option in tooth 21and root canal treatment was done in tooth 11. Before proceeding with the treatment, the risks and possible outcomes of the treatment were comprehensively discussed with the patient and consent was obtained.

PROCEDURE

First visit-An access cavity was madeunder rubber dam, purulent haemorrhagic drainage obtained and the necrotic nature of the pulp confirmed.

The working length was determined by the apex locator and confirmed with a periapical radiograph as shown in Figure 3 and 4.To disinfect the root canal, 5.25% sodium hypochlorite was used. However, a very soft dentinal layer was observed on all canal walls, necessitating peripheral mechanical preparation using a size #80 K-file as shown in Figure 5. Final irrigation was performed using 20 ml of saline as shown in Figure 6 and 7. The canal was dried with paper points, and Triple Antibiotic Paste (Ciprofloxacin, Metronidazole and Minocycline) was placed inside the canal as shown in Figure 8. The medicament is made by mixing equal doses of the three antibiotics with sterile saline to a paste-like consistency. Access cavity was sealed with temporary restorative material (Cavit).

Second visit (After 2 weeks)-Patient was asymptomatic, reporting no pain postoperatively. The temporary restoration was removed and the medication was removed gently from the canal with sterile saline and 5.25 % NaOCl using side vent irrigating needle.

Figure 15. GICrestoration in tooth 21below final post endodontic restoratiom

Figure16. Composite restoration in tooth 21

Figure 17. Post- Operative Clinical Picture

Figure 18. Healing of sinus w.r.t. 21

Figure 19.IOPA after 1 month

Figure 20. IOPA after 3months

Figure 21. IOPA after 6 months

The canal appeared clean and dry, with no signs of inflammatory exudates. A sterile size #15 K-file was used to irritate the tissue gently to create some bleeding into the canal as shown in Figure 9. Bleeding should be controlled so that it does not extend beyond a point approximately 3 mm apical to the CEJ as shown in Figure 10 and 11 . The bleeding was left for 1 min so that the blood clot was formed as shown in Figure 12. Manipulation of MTA was done and inserted against coronal region of the canal; successive increments were condensed with hand pluggers until a thickness of 5 mm was achieved as shown in Figure 13 and 14. The root canal was packed with a moist cotton pellet, & temporary cement was used for sealing of the access cavity.

Third visit (1day later): Cotton pellet was removed over the set MTA &temporary cement was removed.GIC and composite resin were used for the post-endodontic restoration as shown in Figure 15 and 16.The patient was recalled for follow-ups after seven day, one, three, six, and nine months. After one month-the patient was asymptomatic, with no signs of the sinus tract as shown in Figure 17 and 18. The radiograph showed resolution of the radiolucency. After six months, the patient continued to be asymptomatic with radiographic evidence of continuing thickness of dentinal walls(0.5mm) as shown in figure19, 20 and 21.

DISCUSSION

Regenerative procedures have gained significant attention in the management of nonvital teeth, which have traditionally been treated with RCT. In the current case, tooth 21 had experienced an old trauma of 8 years ago, resulting in pulp tissue devitalization and cessation of tooth development. This trauma is responsible for the atypical flat shape of the open apex observed in the tooth.The wide size of the canal and thin dentinal walls prompted the use of root canal revascularization as it minimizes the need for extensive mechanical canal preparation, thereby preserving the thickness of the dentinal walls (8). Three parameters determine the efficacy of "pulp revascularization treatment": "root canal disinfection, the existence of a scaffold (blood clot), and the hermetic coronary seal" (Hoshino et al., 1996) (9). In the case presented here, mechanical instrumentation cannot be performed in these teeth because of the open apex and thin dentinal walls. So, the removal of necrotic tissue from the root canal is accomplished by gently irrigating the root canal with NaOCl because of its tissue dissolving ability & potent antimicrobial activity. When irrigating with NaOCl, it is extremely important to ensure that the irrigating needle is loose in the canal and that the NaOCl irrigation is performed very slowly. The needle should be introduced into the root canal to a point 2 mm short of the apical foramen (10). Triple antibiotic pasteused in this case, proposed by Hoshino et al., for disinfection of the canal. Triple antibiotic paste (TAP) was proved to be biocompatible & can help promote functional development of the pulp–dentin complex.

Studies have proven that formulations of paste can be utilised at 0.1 mg/mL, which is antibacterial but has little influence on survival ofStem cells from apical papilla (SCAP) (Ruparel et al., 2012). Conversely, recent research found that 0.1 mg/mL concentrations were ineffective to eliminate bacteria entirely from simulated "necrotic immature permanent teeth"; 10 mg/mL of Triple antibiotic paste (TAP) was the most efficient medicament which allowed complete elimination of microorganisms from the Root Canal system while allowing a small percentage of Stem cells from apical papilla (SCAPs) to survive (Latham et al., 2016). Blood clot was created in the canal after disinfection. This approach has been supported by many researchers. This blood clot acts as a matrix for the growth of new tissue into the pulp space. Researchers have assumed that stable blood clot serve as a scaffold & provide factors that stimulate their cell growth and differentiation of these cells into odontoblast-like cells (11).Double seal with MTA to a level below the CEJ covered by a bonded resin coronal restoration was created to achieve good sealing (12).The sealing properties and excellent biocompatibility of MTA makes it the material of choice for clot protection. In teeth with open apices, it is possible that some pulp tissue may have survived apically, even though most of the pulp is devitalized and heavily infected. Some authors suggested that regeneration can occur from vital pulp cells remaining at the apical end of the root canal, the multipotent dental pulp stem cells, stem cells in the periodontal ligament and stem cells from apical papilla (13).

CONCLUSION

The effectiveness of revascularization today is mostly dependent on stem cells from the apical papilla, an appropriate blood clot scaffold, and a good coronal seal with a biomaterial, such as MTA.It is worth attempting revascularization, because the advantage of this procedure lies in the possibility of further root development and reinforcement of dentinal walls by deposition of hard tissue, thus strengthening the root against fracture. Few limitations of revascularization are long-term clinical results are as yet not available and whether the newly regenerated tissue is truly pulp or only pulp-like is also uncertain.

REFRENCES

1. Young GR, Parashos P, Messer HH. The principles of techniques for cleaning root canals. Aust Dent J. 2007; 52:52–63.
2. Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dent Traumatol. 2002; 18:134–7.
3. Murray PE, Garcia-Godoy F, Hargreaves KM. Regenerative endodontics: A review of current status and a call for action. J Endod2007; 33:377-90.
4. Ismaeal SH, Elhendawy FA, Khattab A. Evaluation of blood clot and collagen sponge in regeneration of nonvital immature permanent anterior teeth. Tanta Dent J 2023; 20:54.
5. Zeng Q, Nguyen S, Zhang H, Chebrolu HP, Alzebdeh D, Badi MA, *et al*. Release of growth factors into root canal by irrigations in regenerative endodontics. J Endod 2016; 42:1760-6.
6. Huang GT, Sonoyama W, Liu Y, Liu H, Wang S, Shi S. The hidden treasure in apical papilla: The potential role in pulp/dentin regeneration and bioroot engineering. J Endod2008; 34:645-51.
7. F. Banchs and M. Trope, "Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol?" Journal of Endodontics, vol. 30, no. 4, pp. 196–200, 2004.
8. Hong S, Chen W, Jiang B. A comparative evaluation of concentrated growth factor and platelet-rich fibrin on the proliferation, migration, and differentiation of human stem cells of the apical papilla. J Endod2018; 44:977-83.
9. Chaudhari, P., Chandak, M., Chandak, M., Sarangi, S., Jaiswal, A. and Patel, A., 2022. Integrative management of open apex with regenerative endodontic therapy: A case report.Medical science2022;ms151e2124.

10. Banchs F, Trope M. Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol. J Endod. 2004; 30:196–200.
11. Huang GT, Sonoyama W, Liu Y, *et al*. The hidden treasure in apical papilla: the potential role in pulp/dentin regeneration and bioroot engineering. J Endod. 2008; 34:645–51.
12. Jung IY, Lee SJ, Hargreaves KM. Biologically based treatment of immature permanent teeth with pulpal necrosis: a case series. J Endod. 2008; 34:876–87.
13. Gronthos S, Brahim J, Li W, Fisher LW, Cherman N, Boyde A. Stem cell properties of human dental pulp stem cells. J Dent Res. 2002; 81:531-35

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