Regenerative Endodontic Treatment in Maxillary Central Incisor: A 6-month Case Report

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Abstract

The most important cause of pulpal necrosis was trauma during an eruption of the tooth, trauma cause delayed root formation, which leads to fracture of root. In recent advancements in the field of dentistry we can convert non-vital teeth into vital once again by regenerative endodontic procedure. There are many procedures we can included in the regenerative are root canal revascularization, pulp implant, stem cell therapy, gene therapy and injectable scaffolds. In this case report we discuss the successful regenerative endodontic treatment of necrotic permanent maxillary left central incisor. On clinical and radiographic examination the large periapical defect in respected tooth end. After local anesthesia administration, rubber dam placed, access cavity preparation will be done with sterilization protocol, irrigation with the irrigation material for the choice was 1.25% of sodium hypochlorite with saline after proper irrigation no filing will be done at this point of time after this calcium hydroxide will be placed in the dry canal after 3 months follow, intraoral periapical radiograph shows less radiolucent area as compare to baseline radiograph and no visible inflammatory sign seen in the surrounding tissue then filing will be done in the canal to induce bleeding after visible bleeding visible in the canal after canal dry MTA will be placed. During the following period the patient as asymptomatic and after a 1-year x-ray the lesion was subsided and followed by root canal treatment completion.

Keywords: *Regenerative, Root canal treatment.*

Introduction

Regenerative endodontic procedures (REPS) is defined as biologically based procedures designed to replace damaged structures such as dentin, root structures, and cells of the pulp-dentin complex. It is a new modality to help the normal function of the pulp, it become an alternative method to heal apical periodontitis. REP is an extension of root canal therapy. In conventional treatment the dentist cleans the root canal and fills the pulp chamber with inert material after cleaning the root canal shape. As compared to the convention root canal, REPS replaces the live tissue cells in pulp tissue. The main goal of REPS is to regenerate tissue present in the pulp and making the function of pulp dentin complex.[1,2]

Before the introduction of REPS in the dental filed apexification procedure was used in the treatment of immature permanent teeth with the use of mineral trioxide aggregate and long term use of calcium hydroxide.[3] This treatment cannot resolve the complete signs and symptoms of pathology. They should affect on root development procedure.[4] In children traumatic injuries are more common in the age group of 8-13 years. The effect of trauma lead to loss of pulp vitality, pulpal necrosis causes difficulty in root formation.[5] The treatment of pulpal necrosis in an immature tooth with an open apex is a challenge for treating dentists due to

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the open apex it was difficult to obtain an apical seal with conventional obturation technique.[6]

In recent years, we are come across with different new treatment procedures in the field of endodontics. Regenerative endodontic treatment procedure help in root formation and apical closure in immure tooth.[5] Regenerative endodontics is defined as "restoration of tissue architecture and biological function of damaged tissues by tissue similar to the original tissue" Revascularization is a regenerative treatment modality and method to biologically replace a diseased dentin and root structure procedure.[7]

This case reports the successful neurogenesis of permanent necrotic central by revascularization approach.

Case Report: A 10-year-old boyreported to the dental clinic with the chief complaint of swelling in the upper front tooth region. The patient has no previous medical and dental history. The patientgivesa history of trauma 2 days ago, which leads to a crown fracture in the upper permanent maxillary left incisor. On extraoral examination, swelling in the upper lip and it will extend till the base of the nose and left eye. On intraoral examination discoloration of the maxillary central incisor was seen, on soft tissue examination reddish-pink gingival, soft and edematous in nature with rolled out margin, no periodontal pocket was appreciated, on Palpation was mildly painful. On radiography examination(Figure1) large encircled lesion was present on the apical area of the root. After clinical and radiographic examination the final diagnosis was made chronic apical periodontitis. Before starting the treatment informed consent was taken from the patient.

Procedure: After local anesthesia 2% administration, rubber dam placed, access cavity preparation will be done with sterilization protocol, irrigation with the irrigation material for the choice was 1.25% of sodium hypochlorite with saline after proper irrigation no filing will be done at this point of time after this calcium hydroxide will be placed in the dry canal after 3 months follow, intraoral periapical radiograph shows less radiolucent area as compare to baseline radiograph and no visible inflammatory sign seen in the surrounding tissue then filing will be done in the canal to induce bleeding after visible bleeding visible in the canal after canal dry MTA will be placed. During the following period the patient as asymptomatic and after a 1-year x-ray the lesion was subsided and followed by working length was taken with apex locator and verified by x-ray+ tooth was filled with MTA root canal treatment completion. During the follow-up appointments, the patient was completely asymptomatic.

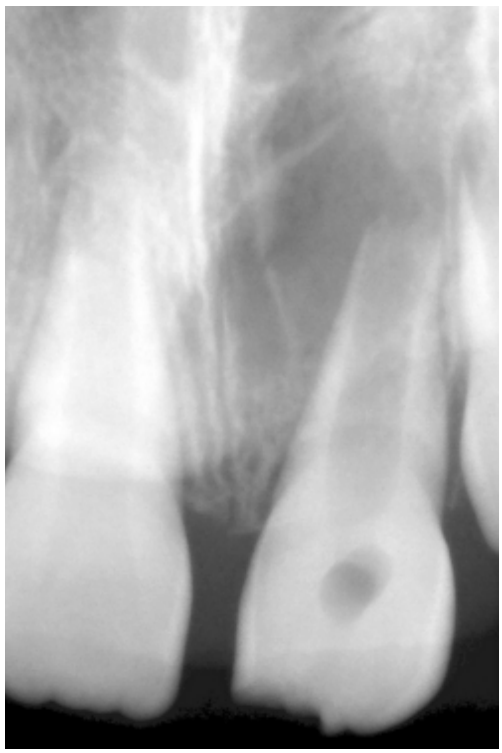

Figure 1. Diagnostic X-ray

Figure 2. Calcium hydroxide placement

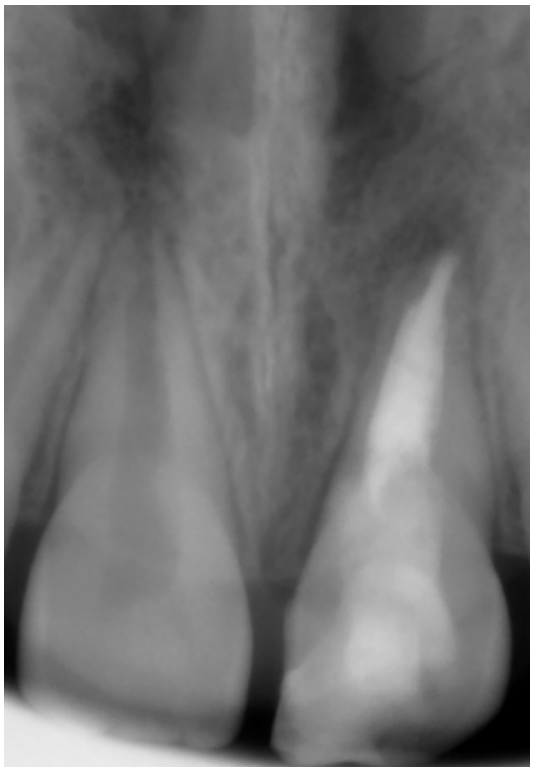

Figure 3. Control x-ray after root canal treatment

Discussion

REPS procedure was founded by Dr. Ostby in 1960. The theory he suggested that the presence of blood clots in the canal promotes healing of the pulp, which helps in the vitality of the pulp. The process was similar to other parts of the body like blood clots help the injury site to repair itself.[8]

To see the above hypothesis, the above case diagnosed with the apical periodontitis received cleaning of canal space followed by placement of medicament after initiation of intracanal bleeding. After 6 months obturation placed coronal to formed blood clot.[9,11]

In various study, authors suggested that REPS can be performed in infected immature permanent tooth because in a clinical trial and histological examination they found mesenchymal stem cells on apical end of the root.[12-16]

These stem cells have the ability to differentiating into odontoblastic cells that helps in forming root dentin and these cells are called SCAP (stem cells of apical papilla) and other cells present in pulp are called dental pulp stem cells (DPSCs). They both can form dentin pulp complex. Both cells are potent to differentiate as mesenchymal cells from the bone. The difference between in these cells like, SCAP showed a greater cell proliferation, number of population doublings, and tissue regeneration as compare DPSCs.[17-19]

Factor affecting the results of revascularization is the degree of infection of the canal, it is difficult to treat the infected tooth with REPS procedure in these types of case triple antibiotic paste or calcium hydroxide paste are used to disinfect the canal.[20] The second important factor was the size of apex during REPS more than 1.1 mm apical diameter is beneficial and the possibility of rev revascularization increases in approximately 18 - 34% of teeth with immature roots. The third factor is age consideration between 8-16 years is more considerable to REPS procedure seen in this group give good results. REPS procedure cannot perform on deciduous teeth because of the possible risk of impairing the eruption pattern of permanent teeth.[20]

In 1996, Hoshino et al. recommended a tri-antibiotic paste, which was composed of ciprofloxacin, metronidazole, and minocycline, to disinfect the canal, and this medicament can be used effectively in regenerative endodontic treatment. On the other hand, Chueh et al. reported that complete disinfection of the canal and regeneration can be achieved by using calcium hydroxide alone.[21]

This case report highlights regenerative endodontic treatmentin maxillary central incisor using $Ca(OH)_2$ and MTA. The most important factor for the successful outcome of the case was the selection of that case and choice of medications used and the technique of sealing the apex. In young children RET shows better results compared to apexification. The disadvantage of apexification was surgery time is more than RET. Postoperative complications are noticed in the apexification like swelling and bleeding.[22]As per the guidelines by the American Association of Endodontists instrumentation in regenerative endodontic procedure are contraindicated because of the chance of fracture in the dentinal wall.

The most common and potent intra-canal medicament used in dentistry was $Ca(OH)_2$. The benefit of $Ca(OH)_2$ prevent infection and have the ability to improve the length of root and thickness of the wall as showed in the study done by Bose et al and MTA was used in RET cases. MTA has sealing properties and excellent biocompatibility makes it the material of choice in RET procedure.MTA is composed primarily

of Portland cement and bismuth oxide such as other MTA products. MTA contains calcium carbonate and a chloride accelerator.[23,24]

Conclusions

Case shows the management of an immature maxillary central incisor reported on successful regenerative endodontic procedure done using calcium hydroxide and MTA. For future clinical studies the comparing RET with $Ca(OH)_2$ and apexification techniques are needed to see the better effect of RET on periapical healing in the central incisor.

Conflict of Interests: The authors declare they have no conflicts of interest.

Ethical Issues: Approved

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References

1. Andreasen, J.O.; Farik, B.; Munksgaard, E.C. Long-term calcium hydroxide as a root canal dressing may increase the risk of root fracture. Dent. Traumatol. 2002, 18, 134–137.
2. Maturo, P.; Costacurta, M.; Bartolino, M.; Docimo, R. MTA applications in pediatric dentistry. Oral Implantol. 2009, 2, 37–44.
3. Iwaya, S.I.; Ikawa, M.; Kubota, M. Revascularization of an immature permanent tooth with apical periodontitis and sinus tract. Dent. Traumatol. 2001, 17, 185–187.
4. Thibodeau, B.; Trope, M. Pulp revascularization of a necrotic infected immature permanent tooth: Case report and review of the literature. Pediatr. Dent. 2007, 29, 47–50.
5. Trope, M. Treatment of the immature tooth with a non-vital pulp and apical periodontitis. Dent. Clin. N. Am. 2010, 54, 313–324.
6. Banchs, F.; Trope, M. Revascularization of immature permanent teeth with apical periodontitis: New treatment protocol? J. Endod. 2004, 30, 196–200.
7. Rafter, M. Apexification: A review. Dent. Traumatol. 2005, 21, 1–8.
8. Simon, S.; Rilliard, F.; Berdal, A.; Machtou, P. The use of mineral trioxide aggregate in one-visit apexification treatment: A prospective study. Int. Endod. J. 2007, 40, 186–197.
9. Witherspoon, D.E.; Small, J.C.; Regan, J.D.; Nunn, M. Retrospective analysis of open apex teeth obturated with mineral trioxide aggregate. J. Endod. 2008, 34, 1171–1176.
10. Jeeruphan, T.; Jantarat, J.; Yanpiset, K.; Suwannapan, L.; Khewsawai, P.; Hargreaves, K.M. Mahidol study 1: Comparison of radiographic and survival outcomes of immature teeth treated with either regenerative endodontic or apexification method—A retrospective study. J. Endod. 2012, 38, 1330–1336.
11. Jung, I.Y.; Lee, S.J.; Hargreaves, K.M. Biologically based treatment of immature permanent teeth with pulpal necrosis: A case series. J. Endod. 2008, 34, 876–887.
12. Ding, R.Y.; Cheung, G.S.; Chen, J.; Yin, X.Z.; Wang, Q.Q.; Zhang, C.F. Pulp revascularization of immature teeth with apical periodontitis: A clinical study. J. Endod. 2009, 35, 745–749.
13. Cehreli, Z.C.; Isbitiren, B.; Sara, S.; Erbas, G. Regenerative endodontic treatment (revascularization) of immature necrotic molars medicated with calcium hydroxide: A case series. J. Endod. 2011, 37, 1327–1330.
14. Kim, S.G.; Malek, M.; Sigurdsson, A.; Lin, L.M.; Kahler, B. Regenerative endodontics: A comprehensive review. Int. Endod. J. 2018, 51, 1367–1388.
15. Thibodeau, B.; Teixeira, F.; Yamauchi, M.; Caplan, D.J.; Trope, M. Pulp revascularization of immature dog teeth with apical periodontitis. J. Endod. 2007, 33, 680–689.
16. Petrino, J.A.; Boda, K.K.; Shambarger, S.; Bowles, W.R.; McClanahan, S.B. Challenges in regenerative endodontics: A case series. J. Endod. 2010, 36, 536–541.
17. Lovelace TW, Henry MA, Hargreaves KM, Diogenes A. Evaluation of the delivery of mesenchymal stem cells into the root canal space of necrotic immature teeth after clinical regenerative endodontic procedure. J Endod. 2011;37:133–138.
18. Kim JY, Xin X, Moioli EK, Chung J, Lee CH, Chen M, Fu SY, Koch PD, Mao JJ. Regeneration of dental-pulp-like tissue by chemotaxis-induced cell homing. Tissue Eng Part A. 2010;16:3023–3031.
19. Garcia-Godoy F, Murray PE. Recommendations for using regenerative endodontic procedures in permanent immature traumatized teeth. Dent

Traumatol. 2012;28:33–41.

20. Chueh LH, Huang GT. Immature teeth with periradicular periodontitis or abscess undergoing apexogenesis: a paradigm shift. J Endod. 2006;32:1205–1213.
21. Chueh LH, Ho YC, Kuo TC, Lai WH, Chen YH, Chiang CP. Regenerative endodontic treatment for necrotic immature permanent teeth. J Endod. 2009;35:160–164.
22. Ding RY, Cheung GS, Chen J, Yin XZ, Wang QQ, Zhang CF. Pulp revascularization of immature teeth with apical periodontitis: a clinical study. J Endod. 2009;35:745–749.
23. Jung IY, Lee SJ, Hargreaves KM. Biologically based treatment of immature permanent teeth with pulpal necrosis: a case series. J Endod. 2008;34:876–887.
24. Kim JH, Kim Y, Shin SJ, Park JW, Jung IY. Tooth discoloration of immature permanent incisor associated with triple antibiotic therapy: a case report. J Endod. 2010;36:1086–1091.