Case report

CONSERVATIVE TREATMENT OF A TOOTH WITH INCOMPLETE ROOT DEVELOPMENT AND A LARGE PERIAPICAL LESION - A CASE REPORT

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ABSTRACT:

Background: Regenerative endodontic procedures have become increasingly popular in recent years. This paper reports the use of regenerative endodontics in the treatment of a large cyst-like inflammatory periapical lesion in an immature permanent tooth.

Case report: A 12-year-old boy with a submucosal abscess in the upper jaw visited the Department of Pediatric Dentistry. Previous injury in the area was reported. The X-ray showed a well-defined large osteolytic lesion engaging the apical part of the root. The initial treatment plan included creation of MTA plug and apical surgery. Throughout the treatment course, the patient skipped his appointments and returned 8 months later. The initial working length couldn't be reached, and a hard barrier was present in the middle portion of the root canal. The CBCT showed that the size of the lesion had decreased significantly. Bone-like tissue with a density similar to surrounding spongiosis was observed in the root canal. There was no change in the contour and length of the root walls.

Conclusion: Regenerative endodontics could be successfully used in the treatment of some immature permanent with necrotic pulp and large periapical lesions.

Keywords: Regenerative endodontics, large periapical lesion, immature permanent teeth

BACKGROUND

The treatment of teeth with large periapical lesions is in itself a real challenge for the clinician. [1] The difficulty increases tremendously when it comes to permanent teeth with incomplete root development. The treatment protocol involves the use of calcium hydroxide for an extended period or mineral trioxide aggregate (MTA) in one visit to form a hard tissue barrier in the apical area. [2, 3] Regenerative endodontic procedures have become increasingly popular in recent years. They are biologically based approach in treatment of immature permanent teeth with necrotic pulp. [4] They allow the replacement of damaged structures like root dentin and cells of the pulp-dentin complex. [5] This approach can be used in the treatment of complicated clinical situations such as dens invaginatus, non-surgical treatment of permanent teeth with incomplete

root development, or large cyst-like inflammatory periapical lesions in teeth with complete root development. [6-8]

The objective of this case report is to present a regenerative endodontics treatment for a large cyst-like inflammatory periapical lesion in an immature permanent tooth.

CASE DESCRIPTION

A 12-year-old boy with a submucosal abscess in the upper jaw was referred to the Department of Pediatric Dentistry, Faculty of Dental Medicine at the Medical University of Sofia. Parents reported a fall injury from a bicycle five years ago in the area of the maxillary front teeth. No dental care was sought after the incident, and no treatment was provided, including follow-up of the teeth from the affected area. The parents did not report any concomitant diseases; the child is clinically healthy and has no contraindications for non-surgical endodontic treatment.

Clinical exam

Extraoral status

The clinical examination revealed facial asymmetry and redness of the skin in the middle of the upper lip. Enlarged lymph nodes were not palpated.

Intraoral status

Intraorally reddening of the mucosa in the area of the maxillary front teeth was observed. The swelling was painful on touch and with slight fluctuation. Tooth 11 was discolored and had a second degree of mobility, painful on percussion. The tooth did not respond to thermal and electrical vitality tests. Adjacent teeth responded normally to the same tests. The patient's oral hygiene was neglected.

Radiographic finding

CBCT of the affected area was performed. (Fig. 1)

The image showed a well-defined osteolytic lesion in the apical area of tooth 11. The lesion engaged the apical part of the root and had diameters of 14 mm and 13 mm (Fig. 1). There was inflammatory resorption of the vestibular compact (Fig. 2). The apex of the tooth was wide open; the length of the root was shorter than that of the adjacent tooth 21. The walls of the root were thin and divergent. The lesion extended to the apex of tooth 12. (Fig. 2)

Fig. 1. Primary CBCT revealing a large periapical lesion in the area of the apex of tooth 11 with a diameter of 11 mm.

Fig. 2. A transverse section in the initial CBCT. A) Osteolytic lesion with perforation of the vestibular compact of the alveolar bone. B) Size of the lesion in the sagittal direction.

Diagnosis and treatment plan

Based on the subjective symptoms and the data from the clinical examination of tooth 11, a preliminary clinical diagnosis of acute apical abscess was made due to the presence of apical swelling, pain, lack of response to vitality tests, crown discoloration and pain on percussion. It was decided to proceed with the technique of sealing the apex with MTA, as the size and configuration of the apical area would not allow routine conservative treatment of the lesion. After placement of the apical plug, the lesion was planned to be treated surgically. The proposed treatment

plan was discussed with the parents, and informed consent was obtained. The periapical lesion affected tooth 12. The clinical exam and the performed vitality tests showed preserved vitality of the dental pulp. There was no need for treatment at the moment, and the tooth will be monitored.

Treatment

First stage

Emergency dental treatment was performed on tooth 11. A rubber dam was placed, trepanation was performed, and purulent exudate was evacuated from the endodontic

access cavity. This was followed by irrigation with 2.0% hypochlorite (Chloraxid 2.0% / sodium hypochlorite CERKAMED Poland) and EDTA 17% (EDTA; ENDOSOLution CERKAMED Poland). Temporary filling was placed (Cavit, 3M Espe, Seefeld, Germany). Due to the massive extraoral collateral edema, an antibiotic was prescribed: Augmentin tablets 625 mg every 8 hours. For the next three days, the patient visited the office daily; the described irrigation protocol was applied until the symptoms subsided and the exudation from the root canal was reduced.

Second stage

After 2 weeks, the tooth was isolated with a rubber dam. An approximate working length was measured with an apex locator (RAYPEX® 6 Apex Locator VDW GmbH Munich Germany), and it was confirmed by image diagnostics. The root canal was prepared with XP-endo Finisher (FKG Dentaire SA, La Chaux de Fonds, Switzerland) for 1 minute, followed by irrigation with hypochlorite, EDTA 17%, and saline. The canal was dried with paper points. At this point, exudation from the root canal was observed. Intermediate medication with triple antibiotic paste was applied. The paste containing clindamycin, metronidazole, and ciprofloxacin was mixed extempore in a macrogol vehicle. The tooth was closed with temporary filling by GC (GC Fuji IX GP, GC Corporation, Tokyo, Japan). After 3 weeks, the tooth was isolated and reopened. Serous exudate continued to emerge from the canal. Irrigation was performed again with sodium hypochlorite and saline, followed by activation of the solution with XP-endo Finisher for 1 minute for each solution. The last activation provoked unintentional bleeding from the root canal. An intermediate medication with calcium hydroxide (Calcipast, CerKamed, Stalowa Wola, Poland) was placed. The access cavity is sealed with glass-ionomer cement as a temporary filling. At this stage, the patient had no pain on palpation, percussion, and chewing. There was no extra- and intraoral edema and tooth mobility was reduced. For the next visit, it was planned to make the apical plug and the restoration of the tooth, and 1 week after that, the surgery is scheduled.

Third stage

The patient did not appear at the next visit. He appeared after 8 months. Tooth 11 was asymptomatic. It was decided to continue the treatment according to the initial treatment plan and to make an apical plug of MTA. The tooth was re-isolated, followed by rinsing with hypochlorite, activation with XP-Endo finisher for 1 min, rinsing with EDTA 17%, new activation for 1 min with XP-Endo finisher to remove calcium hydroxide. It was impossible to reach the initial working length. A K-file was carefully introduced into the canal, and in 10 mm from the incisal edge presence of a hard barrier was felt. The canal was rinsed with saline; it was then dried with paper points. White MTA (MTA - ANGELUS Londrina – PR - Brazil) with a thickness of 2 mm and sterile cotton with saline solution was placed, after which the tooth was closed with a temporary filling. Control x-ray (Fig. 3) and CBCT (Fig. 4) were

performed. They showed that the size of the lesion had decreased significantly. Bone-like tissue with a density similar to surrounding spongiosis was observed in the root canal. There was no change in the contour and length of the root walls. At this stage, the need for surgery was estimated as unnecessary in the context of achieved healing results.

Fig. 3. Control x-ray after MTA placement.

One week later, a fiber post was placed, and a complete restoration of the clinical crown of the tooth with composite was performed.

Two years later, the tooth is still asymptomatic but discolored. The control x-ray showed that the lesion was completely healed. (Fig. 5)

DISCUSSION

This clinical case presents a successful treatment of a large periapical lesion in an immature permanent tooth using regenerative endodontics. Given the initial characteristics of the lesion, the treatment plan included a surgical approach. After provoking bleeding in the root canal unintentionally, the formation of a bone-like structure in its apical half occurred, and complete healing of the osteolytic lesion followed (Fig. 5). Provoking bleeding allows mesenchymal stem cells and growth factors to enter the root canal. [9] The exact range of regenerative properties of mesenchymal stem cells is not yet fully known. These cells function through various mechanisms due to their inherent differential plasticity, angiogenic and immunomodulatory properties. [10]

The nature of the tissue formed in the root canal of a tooth with incomplete root development after regenerative endodontic procedures (REP) may be from the periodontal ligament, cement-like or bone-like tissue with multiple blood vessels. [11, 12] Progressive root canal mineralization observed, in this case, coincides with histological findings reported in other studies performed on human immature permanent teeth. [13, 14]

Cases of successful application of REP in permanent teeth with complete root development with necrotic pulp and small or cyst-like periapical lesions have been described. [8, 15, 16] The presented case shows that such an approach would also be successful in teeth with incomplete

Fig. 4. CBCT after MTA placement

Fig. 5. Two years after completion of treatment. The periapical lesion has completely disappeared.

root development. The main challenge for achieving a positive healing result is the disinfection of the root canal system. [7] The presence of residual bacteria hurts the newly formed tissue and reduces the chance of completing root development. [17] In this case, disinfection was achieved by combining copious irrigation with sodium hypochlo-

rite and EDTA, intracanal medication with Ca (OH)₂ and minimal preparation with XP-endo Finisher.

Mechanical instrumentation of the root canal in teeth with incomplete root development is an additional challenge and can lead to thinning of the root walls and increase the risk of fracture. [18] In a previous study, we were able to prove that the use of XP-endo Finisher in teeth with incomplete root development leads to minimal loss of root dentin. [19] In addition, this file improves the removal of calcium hydroxide and reduces the number of microorganisms in the root canal. [20, 21] In this case, calcium hydroxide was applied as an intermediate medication for additional disinfection and to use its hygroscopic effect due to the continued exudation. [22] Although we did not aim for regeneration, thanks to a hyperactive reaction of the body, the canal was filled with osteoid tissue, and the lesion is completely healed.

CONCLUSION

This case report shows that REP could be successfully applied in the treatment of immature permanent with necrotic pulp and large periapical lesions. Clinical trials are needed to determine the success rate and survival of these types of teeth.

REFERENCES:

1. Karamifar K, Tondari A, Saghir MA. Endodontic Periapical Lesion: An Overview on the Etiology, Diagnosis and Current Treatment Modalities. *EurEndod J*. 2020 Jul 14;5(2):54-67. [PubMed]
2. Cvek M. Treatment of non-vital permanent incisors with calcium hydroxide. I. Follow-up of periapical repair and apical closure of immature roots. *Odontol Revy*. 1972; 23(1):27-44. [PubMed]
3. Mente J, Leo M, Panagidis D, Ohle M, Schneider S, Lorenzo Bermejo J, et al. Treatment outcome of mineral trioxide aggregate in open apex teeth. *J Endod*. 2013 Jan;39(1):20-6. [PubMed]
4. Mari-Beffa M, Segura-Egea JJ, Diaz-Cuenca A. Regenerative Endodontic Procedures: A Perspective from Stem Cell Niche Biology. *J Endod*. 2017 Jan;43(1):52-62. [PubMed]
5. Diogenes A, Ruparel NB, Shiloah Y, Hargreaves KM. Regenerative endodontics: A way forward. *J Am Dent Assoc*. 2016 May;147(5): 372-80. [PubMed]
6. Kaya-Büyükbayram I, Özalp S, Aytugur E, Aydemir S. Regenerative endodontic treatment of an infected immature dens invaginatus with the aid of cone-beam computed tomography. *Case Rep Dent*. 2014; 2014: 403045. [PubMed]
7. Cymerman JJ, Nosrat A. Regenerative Endodontic Treatment as a Biologically Based Approach for Non-Surgical Retreatment of Immature Teeth. *J Endod*. 2020 Jan;46(1):44-50. [PubMed]
8. Saoud TM, Sigurdsson A, Rosenberg PA, Lin LM, Ricucci D. Treatment of a large cystlike inflammatory periapical lesion associated with mature necrotic teeth using regenerative endodontic therapy. *J Endod*. 2014 Dec;40(12):2081-6. [PubMed]
9. 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 the clinical regenerative endodontic procedure. *J Endod*. 2011 Feb;37(2): 133-8. [PubMed]
10. Brizuela C, Meza G, Urrejola D, Quezada MA, Concha G, Ramirez V, et al. Cell-Based Regenerative Endodontics for Treatment of Periapical Lesions: A Randomized, Controlled Phase I/II Clinical Trial. *J Dent Res*. 2020 May;99(5):523-9. [PubMed]
11. Shah D, Lynd T, Ho D, Chen J, Vines J, Jung HD, et al. Pulp-Dentin Tissue Healing Response: A Discussion of Current Biomedical Approaches. *J Clin Med*. 2020 Feb 5; 9(2):434. [PubMed]
12. Nosrat A, Kolahdouzan A, Hosseini F, Mehrizi EA, Verma P, Torabinejad M. Histologic Outcomes of Uninfected Human Immature Teeth Treated with Regenerative Endodontics: 2 Case Reports. *J Endod*. 2015 Oct;41(10):1725-9. [PubMed]
13. Song M, Cao Y, Shin SJ, Shon WJ, Chugal N, Kim RH, et al. Revascularization-associated Intracanal Calcification: Assessment of Prevalence and Contributing Factors. *J Endod*. 2017 Dec;43(12): 2025-33. [PubMed]
14. Nosrat A, Kolahdouzan A, Khatibi AH, Verma P, Jamshidi D, Nevins AJ, et al. Clinical, Radiographic, and Histologic Outcome of Regenerative Endodontic Treatment in Human Teeth Using a Novel Collagen-hydroxyapatite Scaffold. *J Endod*. 2019 Feb;45(2):136-43. [PubMed]
15. Paryani K, Kim SG. Regenerative endodontic treatment of permanent teeth after completion of root development: a report of 2 cases. *J Endod*. 2013 Jul;39(7):929-34. [PubMed]
16. Saoud TM, Martin G, Chen YH, Chen KL, Chen CA, Songtrakul K, et al. Treatment of Mature Permanent Teeth with Necrotic Pulps and Apical Periodontitis Using Regenerative Endodontic Procedures: A Case Series. *J Endod*. 2016 Jan;42(1):57-65. [PubMed]
17. Verma P, Nosrat A, Kim JR, Price JB, Wang P, Bair E, et al. Effect of Residual Bacteria on the Outcome of Pulp Regeneration In Vivo. *J Dent Res*. 2017 Jan;96(1):100-6. [PubMed]
18. Saoud TMA, Ricucci D, Lin LM, Gaengler P. Regeneration and Repair in Endodontics-A Special Issue of the Regenerative Endodontics-A New Era in Clinical Endodontics. *Dent J (Basel)*. 2016 Feb 27;4(1):3. [PubMed]
19. Hristov K, Gateva N, Stanimirov P, Ishkitiev N, Doitchinova L. Comparative Analysis of Root Dentin Loss when Using Modern Mechanical Cleaning Instruments in Immature Permanent Teeth. *Folia Med (Plovdiv)*. 2020 Jun 30; 62(2):352-7. [PubMed]
20. Uygün AD, Gündoğdu EC, Arslan H, Ersoy I. Efficacy of XP-endo finisher and TRUShape 3D conforming file compared to conventional and ultrasonic irrigation in removing calcium hydroxide. *Aust Endod J*. 2017 Aug; 43(2):89-93. [PubMed]
21. Carvalho MC, Zuolo ML, Arruda-Vasconcelos R, Marinho ACS, Louzada LM, Francisco PA, et al. Effectiveness of XP-Endo Finisher in the reduction of bacterial load in oval-shaped root canals. *Braz Oral Res*. 2019; 33:e021. [PubMed]
22. Leonardo MR, da Silva LA, Leonardo Rde T, Utrilla LS, Assed S. Histological evaluation of therapy using a calcium hydroxide dressing for teeth with incompletely formed apices and periapical lesions. *J Endod*. 1993 Jul;19(7):348-52. [PubMed]

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