A novel technique for non-surgical management of open apex using bio mimetic material: A case report

Naveen Chhabra[1,*], Hitesh C. Gyanani[2]

[1]Reader, KM Shah Dental College & Hospital, Vododara, Gujarat, [2]Senior Lecturer, Swargiya Dadasaheb Kalmegh Smruti Dental College & Hospital, Nagpur, Maharashtra

***Corresponding Author:**
Email: drnaveenchhabra@yahoo.com

Abstract

Frequent occurrence of dental trauma in the early childhood often leads to persistence of immature nonvital tooth supplemented by periapical periodontitis as well as inflammatory external root resorption. Such teeth pose several difficulties in front of the clinician primarily due to absence of definite apical stop. The present case report highlights the nonsurgical endodontic management of a similar case in a novel way with long term clinically favourable outcome.

Keywords: Apexification; Calcium Hydroxide; Mineral trioxide aggregate; Regeneration; Sodium Hypochlorite.

Introduction

Traumatic injuries to teeth are common in early childhood, frequently involving maxillary incisors[1]which may lead to nonvital teeth with immature root apex and in many cases if not timely treated, may accompany periapical periodontitis and root resorption as well.[2]

Axioms of endodontic therapy are adequate access, cleaning and shaping followed by three dimensional sealing of the root canal system. Non-vital teeth with immature apex often create a challenge to the clinician. The main reasons include difficulty in working length estimation due to proliferation of inflammatory periapical tissue into the root canal space, higher chances of apical extrusion of irrigating solution and inability to seal the apical third of the root canal system.[3] Various treatment modalities are recommended for the management of such cases which include long term apexification with calcium hydroxide[4], retrograde root end filling using various restorative materials, formation of apical plug using tricalcium phosphate[5], mineral trioxide aggregate[6] and more recently the pulp revascularisation.[7]

Concept of apical matrix has also been suggested in conjunction with apical plug; various materials have been used as material of choice to create the apical matrix such as collagen[8], hydroxyapatite[9], demineralised freeze dried bone graft[10], platelet rich plasma or combination of platelet rich plasma and hydroxyapatite.

More recently the successful use of hydroxyapatite as an apical matrix as well as bio mimetic obturation in the apical third of the root canal with same has been suggested.[11] This article reports the use of hydroxyapatite as an apical barrier as well as obturation material in the apical one third of root with a clinically acceptable outcome.

Case Report

A patient aged 24 years reported to dental clinic with the chief complaint of discolouration in upper front region of oral cavity since 15 years. Patient gave the history of fall injury 15 years back which caused trauma to maxillary anterior teeth. Patient also gives history of dull pain since 1 month which aggravated while mastication. Intraoral examination revealed Ellis class II fracture in relation to tooth 11 and Ellis class III fracture with respect to 21 also the presence of draining sinus was observed in labial vestibule with respect to tooth 11 and 21. Also tooth 11 and tooth 21 exhibited grade I mobility as well as revealed discoloured crowns. Both teeth were non responsive to electric pulp testing. The intraoral periapical radiograph of the same showed the presence of periapical radiolucency and open apices with ragged margins in the root apices suggestive of external root resorption. Diagnosis of Chronic periapical periodontitis and pulp necrosis was made in relation to tooth 11 and tooth 21. Prognosis of tooth 21 was assessed to be poor, however, tooth 11 was expected to have fair prognosis. Following treatment plans were suggested;

1. Non-surgical root canal treatment accompanied with apexification using apical barrier technique in relation to both teeth followed by crown rehabilitation,
2. Non-surgical treatment accompanied with apicoectomy and retrograde filling,
3. Extraction of 21 and preservation of tooth 11 using any of the methods above mentioned.

Patient was informed about the treatment and its prognosis. After taking patients consent non surgical endodontic treatment along with apexification was opted treatment of choice. Access opening was accomplished and the teeth were isolated using rubber dam. Working length was determined using electronic apex locator (Root ZX™, Morita, Tokyo, Japan) and radiographic method and the working length was

adjusted accordingly. In both the teeth minimal circumferential filing was done using 80 size K file along with copious amount of 0.5% sodium hypochlorite solution as root canal irrigant. Root canals were finally rinsed with alternate use of 17% EDTA solution and 3% sodium hypochlorite. Later on the canals were dried using absorbent paper points (Dentsply Sirona, Phileadelphia, USA). This was followed by placement of calcium hydroxide powder mixed with distilled water into the root canal spaces.Thereafter the access preparation was sealed using temporary restorative (Cavit™, 3M ESPE, St. Paul, USA)and the patient was recalled after one week. In the subsequent visit the canals were cleaned and irrigated with 3% sodium hypochlorite to remove the calcium hydroxide completely followed by paper drying of canals. An apical stop was created using fine hydroxyapatite powder (G-Bone Synthetic, Surgiwear, Shahjahanpur, India) mixed in distilled water by condensing the suspension into the periapical bone defect using a size 35 finger plugger (Dentsply Sirona, Phileadelphia, USA). The hydroxyapatite suspension was also condensed thoroughly in the apical third of the root canal so that it sealed any irregularities/ crevices present in the apical third of the incompletely formed/ resorbed apical roots. The satisfactory compaction was established by gently tapping the finger plugger against the condensed hydroxyapatite which was also depicted in the intraoral periapical radiograph. Complete obturation of the periradicular bony defect with hydroxyapatite was not evident in the radiograph due to presence of granulation tissue in the bony defect. Remnants of hydroxyapatite were removed with size 80 Hedstroem file in a circumferential motion. Both the canals were then obturated with thermo plasticised guttapercha (Obtura II, Morita, Tokyo, Japan) using an epoxy based sealer (AH Plus™, Dentsply Sirona, Phileadelphia, USA). The tooth 21 required post and core therapy due to extensive loss of crown structure but the treatment was delayed owing to its questionable prognosis. The patient was recalled and evaluated at regular interval of 3 months for 2 years. At each visit the patient was asymptomatic. At 1 year recall the decision of carrying out crown rehabilitation was made. The gutta percha was removed and post space was created using appropriate sized drill and the corresponding glass fiber post (Radix Fiber Post®, Dentsply Sirona, Phileadelphia, USA) was cemented using resin based dual cure luting cement (Calibra®, Dentsply Sirona, Phileadelphia, USA). Subsequently the crown build up was carried out using composite restorative and the patient was discharged. In the subsequent visits both the teeth were rehabilitated using metal ceramic crown prosthesis. At further recall visits at 1.5 and 2 years patient was asymptomatic and IOPA revealed signs of good healing response.

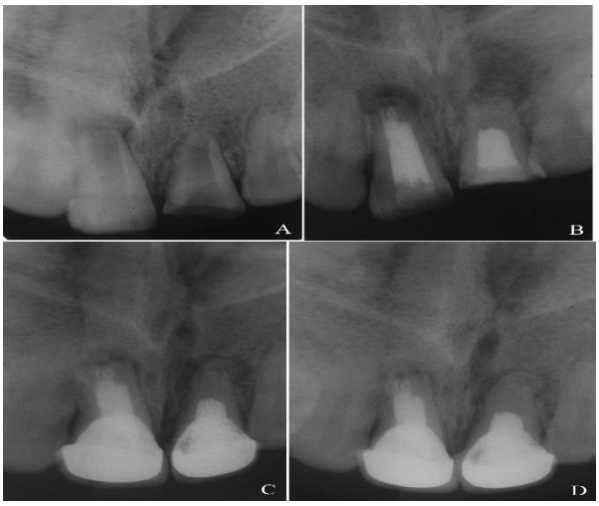

Fig. 1

Discussion

Traumatic injuries especially in maxillary anterior quadrant are common phenomenon especially duringthe developmental stages of permanent dentition. This probably relates to the vulnerable position of the maxillary central incisors. In addition, these teeth are frequently protruded and may have inadequate lip coverage which makes it susceptible to trauma because of sports injury, fall, road traffic accidents, fights, etc.[12] Development of tooth root follows sequential stages; subsequently any injury during these stages may lead to defect in physiologic root development. Cvek has classified root development into 5 stages and trauma during any of these stages may lead to wide open apex/ failure of formation of apical constriction. The aforementioned case presents a similar history of trauma during developmental age, leading to open apex. Absence of definite apical stop is one of the impediments for three dimensional sealing of such cases.

Root canal treatment was initiated and access opening was completed ensuring complete de-roofing of coronal pulp tissue. In the context of present literature owing to higher probability of faulty reading due to the presence of wide open apex, the working length calculated using electronic apex locator was modified according to the Wein's criteria.[3]Another important factor to be taken into consideration in such cases involves presence of larger apical diameter and narrower coronal diameter along with thin apical dentin which has a higher probability of fracture during biomechanical preparation and subsequent obturation procedures.[13]Hence, cleaning and shaping was accomplished by only circumferential filling, which was supplemented with thorough irrigation using 0.5% sodium hypochlorite with hand agitation with syringe to ensure complete disinfection of the root canal system. Irrigation regimen was carried out very carefully to ensure both safety (prevention of over extrusion of hypochlorite)and completeness (copious amount to

compensate for minimal preparation and lower concentration of irrigant).[14]

Despite various advancements in the intracanal medicaments, calcium hydroxide remains the most effective irrigant for complete disinfection of the root canal system, hence, calcium hydroxide was used in the present clinical case. Conventionally calcium hydroxide was used for long periods up to 18 months to achieve complete formation of apical calcific barrier in cases of wide open apex. However, this technique has its own disadvantages like long treatment time, presence of tunnel defects and increased susceptibility to radicular fracture.[4]Final irrigation was carried out using the most recommended protocol of alternately using 17% EDTAand3% sodium hypochlorite, which ensured thorough removal of smear layer as well as microorganisms. A wide array of barrier materials have been tried and tested with varying results; amongst which hydroxyapatite was used in the present case, owing to its osteo-conductive potential, it serves as an excellent scaffold.[15] Various other barrier techniques available include collagen membranes, bone morhpogenic protein, resorbable ceramic and calcium sulphate. More recently revascularisation procedure has gained popularity but again long follow up time and multiple appointments are essential. Present case depicted clinical and radiographic signs of chronic apical periodontitis along with periapical root resorption which might have led to loss of self regenerating potential of periapical tissue. Hence revascularisation was not opted in the present case as it demonstrated inflammatory root resorption with extensive periapical bone defect. Thermo plasticised gutta percha was used for obturation to minimise the chances of fracture of thin dentinal walls under the influence of high condensation forces. Compromised crown root ratio in 21 necessitated the use of post core for retention of the coronal prosthesis but owing to the poor prognosis, the case was followed up for a period of one yearbefore rehabilitating the tooth with final prosthesis.

Conclusion

This case presents an effective alternative to traditional long term calcium hydroxide used for immature tooth in case of traumatic injuries. Unpredictable healing response in this case as well as cost effectiveness as compared to MTA made hydroxyapatite an ideal choice for this situation. Hydroxyapatite used as an apical barrier and apical third obturating material owing to its osteo-conductive potential was quite successful as revealed from the follow radiographs which revealed satisfactory healing. Post and core was successfully accomplished with respect to 21 and fixed prosthesis was delivered fulfilling the patient's expectations with clinical and radiographic success.

References

1. Pavuluri C, Nuvvula S. Management of Traumatic Injury to Maxillary Central Incisors associated with Inverted Mesiodens: A Case Report. Int J Clin Pediatr Dent. 2013;6(1):30-2.
2. Finucane D[1], Kinirons MJ. External inflammatory and replacement resorption of luxated, and avulsed replanted permanent incisors: a review and case presentation. Dent Traumatol. 2003;19(3):170-4.
3. Trope M. Treatment of the immature tooth with a non-vital pulp and apical periodontitis. Dent Clin North Am. 2010;54(2):313-24.
4. Chala S, Abouqal R, Rida S. Apexification of immatureteeth with calcium hydroxide or mineral trioxide aggregate: systematic review and meta-analysis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011;112(4):e36-42.
5. Coviello J, Brilliant JD. A preliminary clinical study on theuse of tricalcium phosphate as an apical barrier. J Endod 1979;5(1):6−13.
6. Lin JC, Lu JX, Zeng Q, Zhao W, Li WQ, Ling JQ. Comparison of mineral trioxide aggregate and calcium hydroxide for apexification of immature permanent teeth: A systematic review and meta-analysis. J Formos Med Assoc. 2016;115(7):523-30.
7. Albuquerque MTP, Nagata JY, Soares AJ, Zaia AA. Pulp revascularization: an alternative treatment to the apexification of immature teeth. Rev Gaúch Odontol, Porto Alegre. 2014;62(4):401-10.
8. Moses O, Pitaru S, Artzi Z, Nemcovsky CE. Healing of dehiscence-type defects in implants placed together with different barrier membranes: A comparative clinical study. Clin Oral Implants Res 2005;16(2):210-9.
9. Chhabra N, Kamatagi L, Chhabra T M, Singbal K P. Successful apexification of a failed root canal treated immature tooth using a novel technique. ENDO 2013;7(2):91–95.
10. Chhabra N, Singbal KP, Kamat S. Successful apexification with resolution of the periapical lesion using mineral trioxide aggregate and demineralised freeze-dried bone allograft. J Conserv Dent. 2010;13(2):106-9.
11. Holland R, De Souza V, Nery MJ, De Mello W, Bernabé PF, Otoboni Filho JA. Tissue reaction following apical plugging of the root canal with infected dentin chips. Oral Surg1980;49(4):366-9.
12. Traebert J, Bittencourt DD, Peres KG, Peres MA, de Lacerda JT, Marcenes W. Aetiology and rates of treatment of traumatic dental injuries among 12 years-old schoolchildren in a town in southern Brazil. Dent Traumatol 2006;22(4):173-8.
13. Kerekes K, Heide S, Jacobsen I. Follow-up examination of endodontic treatment in traumatized juvenile incisors. J Endod. 1980;6(9):744-8.
14. Cvek M, Nord CE, Hollender L. Antimicrobial effect of root canal debridement inteeth with immature root. A clinical and microbiologic study. Odontol Revy 1976;27(1):1–10.
15. Alhadainy HA, Himel VT, Lee WB, El Baghdady YM. Use of a hydroxylapatite-based material and calcium sulfate as artificial floor to repair furcal perforations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;86(6):723–9.

How to cite this article:

Chhabra N, Gyanani HC. A novel technique for non-surgical management of open apex using bio mimetic material: A case report. Ind J Conserv Endod *2016;1(2):58-60*