Management of Open Apex: Case Series

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ABSTRACT : Immature tooth with necrosed pulp and periapical pathology is a major challenge and requires a well-organized treatment plan. Closure of the root apex is required to achieve success in such cases. Many materials have been introduced for apexification each having their own advantages and disadvantages. There is a plethora of research going on in dentistry with the focus not only on the treatment rationale but also on the materials. These endeavors have led to the development of some new materials like Biodentine, Endosequence Root Repair Material, etc. which have revolutionized endodontics. This article is a case series presenting apexification done using Biodentin after the formation of apical barrier using calcium hydroxide. The canal was obturated by using thermoplasticized gutta percha technique using AH plus sealer and coronal seal was achieved by resin bonded composite.

KEYWORDS : Apexification, biodentine, thermoplasticized gutta percha, open apex.

INTRODUCTION

Traumatic injuries to the teeth arecommon among most of the facial injuries. Traumatic injury can occur in any age group but thirty percent of traumatic injuries to the dentition occurs during childhood [1]. Most of these injuries occur before the completion of root formation [2]. Premature loss of vital pulp results in a fragile tooth with a compromised crown-root ratio, thin dentin walls and an apex which is not completely formed [3]. Open apex often requires utmost care by a dentist as roots are more susceptible to fracture and the obturating material can impinge on the periodontal tissues [4]. Management of a non-vital tooth with open apex requires stimulation of the formation of a natural or an artificial apical barrier which will act as a stop for the obturating material. Apexificationis defined as “a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp” [5].Calcium Hydroxide is widely used to induce apical barrier and is considered as a gold standard [6-8]. But the major limitation of this material is the micro leakage occurring during the formation of hard tissue barrier [9]. The current approach is to form an artificial apical barrier by the placement of an apical plug using biocompatible materials. Literature on open apex reveals a number of materials that have been used for creating an artificial apical barrier such as Tricalcium phosphate, Surgicel/amalgam, Freeze-dried bone or dentin, Biodentin and Mineral Trioxide Aggregate (MTA) [10,11]. The first study on these materials was done by Coviello and Brilliant in 1979 and they introduced tricalcium phosphate [12]. In 1993, Schumache and Rutledge suggested calcium hydroxide as a permanent apical barrier [13] and finally Torabinejad and Chivian introduced mineral trioxide aggregate (MTA) as an apical plug [14]. Although MTA has more benefits, using MTA in

teeth with funnel shape apices and large periapical lesions is difficult and also it often spreads beyond the apex [15]. So in this case series calcium hydroxide along with the biodentine was used to treat the open apex.

CASE REPORTS

CASE 1

A 23-year-old female patient named Alanka Khokre reported to the Department of Conservative Dentistry and Endodontics, Saraswati Dhanwantari Dental College, Parbhani with a chief complaint of pain in her upper front tooth region for past two days. Patient gave history of dull throbbing pain for the past 6 months in the same region. Past medical and dental history was non-contributory. Clinical examination showed Ellis Davis Class IV Fracture in upper left central incisor (21). Sensibility test showed no response in 21.Radiographic examination showed blunderbuss canal and a periapical radiolucency in relation to 21. (Figure 1). Based on the clinical examination, sensibility test and radiographic findings, a provisional diagnosis of Ellis Davis Class IV fracture with open apex and periapical pathology was made. Apexification was planned with Biodentine (Septodont). A written consent was taken from the patient after explaining the treatment protocol. In the first visit, Access opening was done under rubber dam (GDC) isolation using endo access bur #1 (Dentsply, Pennsylvania, United States).Canal patency was checked using a #10 K file (Mani, Brussels, Belgium)and working length was determined using Ingle's Radiographic method (Figure 1.1). Biomechanical preparation was done using K files using step back technique. Irrigation was done using 5.25 % NaOCl(Prime Dental Products Pvt. Ltd, India) and saline (Polyamp DuoFit, South Wales, Australia). Chlorhexidine (AnabondAsep-RC, Chennai, India) was used as a final irrigant. Calcium Hydroxide (Voco Calcicur, Cuxhaven, Germany) was placed using a Lentulo spiral (Mani, Brussels, Belgium) and tooth was temporized. Patient was recalled after a week. In the second visit, access cavity was re-established, canal was irrigated copiously following the same protocol and dried with sterile paper points (Mani, Brussels, Belgium).Biodentine (Septodont)was mixed according to the manufacturer's protocol and and packed to a thickness of 4 mm in the apical third using a hand plugger (Mani, Brussels, Belgium) (Figure 1.2). A sterilecotton pellet was placed in the canal andthe tooth was temporized. Patient was recalled after two days. In the subsequent visit, obturation was done using thermoplasticized gutta-percha (Fig 1.3) (Obtura™ Max, Algonquin, Canada) and Composite resin restoration (3M)was placed to seal the access cavity (Fig 1.4). Patient was recalled after a month for follow up.

Fig 1 (Pre-operative)

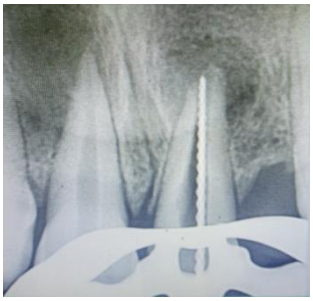

Fig 1.1 (Working Length)

Fig 1.2 (Biodentine plug)

Fig 1.3 (Thermoplasticized Obturation)

Fig 1.4 (coronal seal with composite)

CASE 2

An 18-year-oldfemale patient named Muskan Pathanreported to the department with a chief complaint of pain in her upper front tooth region for past two days. Patient gave history of acute sharp pain in the same region. Past medical and dental history were noncontributory. Clinical examination showed Ellis Davis Class IV Fracture in upper left central incisor (21). Sensibility test showed no response in 21. Radiographic examination showed blunderbuss canal and a periapical radiolucency in relation to 21 (Fig 2). Based on the clinical examination, sensibility test and radiographic findings, a provisional diagnosis of Ellis Davis Class IV fracture with open apex and periapical pathology was made. Apexification was planned with Biodentin. The written consent was taken from the patient after explaining the treatment protocol. In the first visit, Access opening was done under rubber dam and Canal patency was checked as mentioned in the previous case. Working length was determined using Ingle's Radiographic method (Figure 2.1) and Biomechanical preparation was done. Calcium Hydroxide was placed using a Lentulo spiral and tooth was temporized. Patient was recalled after a week (Fig 2.2). In the second visit, access cavity was reestablished, canal was irrigated copiously and dried with sterile paper points. Biodentin (Septodont,Saint-Maur-des-Fossés, France) was mixed according to the manufacturer's protocol and packed to a thickness of 4 mm in the apical third using a hand plugger (Fig 2.3). A sterile cotton pellet was placed in the canal and the tooth was temporized. Patient was recalled after two days. In the subsequent visit, obturation was done using thermoplasticized gutta-percha (Fig 2.4) and Composite resin restoration was used to seal the access cavity (Figure 2.5). Patient was recalled after a month for follow up.

Fig 2 (Pre-Operative)

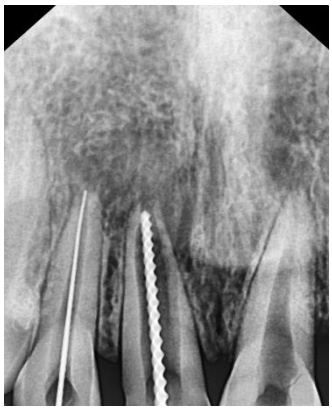

Fig 2.1 (Working length)

Fig 2.2
(Calcific barrier formation)

Fig 2.3
(Biodentine apical plug)

Fig 2.4
(Thermoplasticized obturation)

Fig 2.5
(coronal seal with composite)

CASE 3

A 22-year-oldmale patient name Shaikh Adil reported to the department with a chief complaint of black discolouration in her upper front tooth region for past two days. Patient gave history of traumatic injury in the same region 10 months back. Past medical and dental history were noncontributory. Clinical examination showed Ellis Davis Class IV Fracture in upper left central incisor (12). Sensibility test showed no response in 12. Radiographic examination showed blunderbuss canal and a periapical radiolucency in relation to 12. Based on the clinical examination, sensibility test and radiographic findings, a provisional diagnosis of Ellis Davis Class IV fracture with open apex and periapical pathology was made. Apexification was planned with MTA (Angelus, Londrinas, Brazil). The written consent was taken from the patient after explaining the treatment protocol. The same procedure was followed as done in the earlier cases; in the first visit, Access opening was done and canal patency was checked. Working length was determined using Ingle's Radiographic method. Biomechanical preparation was done and Calcium Hydroxide was placed and tooth was temporized. Patient was recalled after a week. In the second visit, access cavity was reestablished, canal was irrigated copiously and dried with sterile paper points. Biodentine was mixed according to the manufacturer's protocol and and packed to a thickness of 4 mm in the apical third using a hand plugger (Figure 3a). A sterile wet cotton pellet was placed in the canal and the tooth was temporized. Patient was recalled after two days.In the subsequent visit, obturation was done using thermoplasticized guttapercha and Composite resin restoration was used to seal the access cavity. Patient was recalled after a month for follow up.

Fig 3 (Pre-Operative)

Fig 3.1 (Working length)

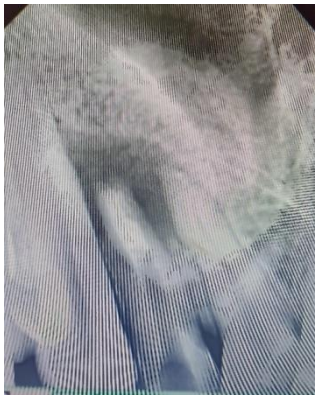

Fig 3.2
(Biodentine apical plug)

Fig 3.3
(Thermoplasticized obturation)

DISCUSSION

Hertwig's epithelial root sheath is formed by the fusion of inner and outer enamel epithelium; which eventually leads to the formation of root [16]. A vital and healthy pulp is required for the thickening of the dentinal walls of the root and closure of the apex. This process takes approximately three years for completion after the eruption of the tooth [17]. Various factors such as trauma or caries can lead to the necrosis of the pulpal tissue; which inhibits normal root formation [18]. Root canal treatment (RCT) of such teeth is very difficult because lack of apical constriction and the presence of open apex do not allow traditional RCT and an apical seal cannot be achieved with common root filling materials [19]. Apexification procedure intends to form a mineralized barrier in the root apex against which

gutta- percha can be condensed in the canal space. With the passage of time many materials have been modified by research in material sciences that has evolved dentistry to prove, disprove or facilitate treatment approaches in management of cases [17]. Biodentine is a newer material which is bioactive dentin substitute cement. It is avalaible in a powder-liquid system; powder composed of Tri-calcium silicate, Di-calcium silicate, Calcium carbonate and oxide, Iron oxide, Zirconium oxide. Liquid consist of Calcium chloride, Hydro soluble polymer. Biodentine has a shorter setting time of 12 minutes, as compared with that of MTA, which is 2 hours 45 minutes [20, 21]. Zanini et al suggested that Biodentine is bioactive because it induces differentiation of odontoblast-like cells and increases murine pulp cell proliferation and biomineralization [25].

CONCLUSION

Apexification procedure can be done using various materials and requires utmost care during the procedure as it is very much prone to fracture as the tooth become fragile. Biodentine can be used as a material for the apical plug along with thermoplasticized obturation in the open apex cases.

REFERENCES

1) Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth, 3rdedn. Copenhagen: Munkasgaard 1994.
2) Moore A, Howley MF, O'Connell AC. Treatment of open apex teeth using two types of white mineral trioxide aggregate after initial dressing with calcium hydroxide in children. Dent Traumatol 2011 Jun;27(3):166-73.
3) Ahlawat B, Kumar A, Chaudhary N, Vijaylaxmy, Bhardwaj V. Apexification with Rapid MTA Plug Technique. Indian J.Sci. Res 2015;6(2):153-6.
4) Trope M. Treatment of the Immature tooth with a Non-Vital Pulp and Apical Periodontitis. Dent Clin North Am 2010 Apr;54(2):313-24.
5) American Association of Endodontists. Glossary of endodontic terms, 7thedn. Chicago; 2003.
6) Ghose LJ, Baghdad VS, Hikmat YM. Apexification of immature apices of pulpless permanent anterior teeth with calcium hydroxide. J Endod 1987; 13:285-90.
7) Kerekes K, Heide S, Jacoben I. Follow up examination of endodontic treatment in traumatized juvenile incisors. J Endod 1980; 6:744-8
8) Cvek M. Prognosis of luxated non-vital maxillary incisors treated with calcium hydroxide and filled with gutta-percha; A retrospective clinical study. Endod Dent Traumatol 1992; 8:45-55.
9) Bortoluzzi EA, Broon NJ, Bramante CM, Consolaro A, Garcia RB, Moraes IG, Bernadineli N. Mineral Trioxide Aggregate with or without Calcium Chloride in Pulpotomy. J Endod 2008, Feb;34(2):172-5.
10) Amandeep SU, Mandeep KB, Jagat B, Gulsheen. Apexification. DJAS 2013;1(16).
11) Harbert H. One step apexification without calcium hydroxide. J Endod 1996; 22:690-2.
12) Coviello J, Brilliant JD. A preliminary clinical study on the use of tricalcium phosphate as an apical barrier. J Endod. 1979 Jan;5(1):6-13.

13) Schumacher JW, Rutledge RE. An alternative to apexification. J Endod. 1993 Oct;19(10):529-31.
14) Torabinejad M, Chivian N. Clinical applications of Mineral trioxide aggregate. J Endod. 1999 Mar;25(3):197-205.
15) - Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review--Part III: Clinical applications, drawbacks, and mechanism of action. J Endod. 2010 Mar;36(3):400-13.
16) Simon S, Rilliard F, Berdal A, Machtou P. The use of mineral trioxide aggregate in onevisit apexification treatment: a prospective study. Int Endod J. 2007 Mar;40(3):186-97.
17) Rafter M. Apexification: a review. Dent Traumatol. 2005 Feb;21(1):1-8.
18) Neha K, Kansal R, Garg P, Joshi R, Garg D, Grover HS. Management of immature teeth by dentin-pulp regeneration: a recent approach. Med Oral Patol Oral Cir Bucal. 2011 Nov;16(7): e997-1004.
19) - Ashraf H, Eskandarinezhad M. Biological apexogenesis of undeveloped tooth in a patient with spondyloepiphyseal dysplasia: a case report. Iran Endod J. 2010 Spring;5(2):93-6.
20) Priyalakshmi S, Ranjan M. Review of Biodentine- a bioactive dentin substitute. IOSR Journal of dental and medical sciences 2014;13(1):13-15.
21) Han L, Okiji T. Uptake of calcium and silicon released from calcium silicate-based endodontic materials into root canal dentine. Int Endod J. 2011;44:1081-7.
22) Zanini M, Sautier JM, Berdal A, Simon S. Biodentine induces immortalized murine pulp cell differentiation into odontoblastlike cells and stimulates biomineralization. Journal of Endodontics 2012;38(9):1220-6.

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