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Sealing of root canal with open apex using bio dentine - A case report

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Abstract

Teeth having open apices are a result of arrested root development, incomplete root maturation, or extensive apical root resorption. Irrespective of the etiology of open apices, absence of a natural apical constriction poses several challenges during conventional endodontic treatment, especially when establishing an apical seal. A suboptimal apical seal can increase the likelihood of persistent leaky margins and subsequent nonhealing or recurrence of periapical lesions. Traditionally, surgical intervention is commonly adopted in the management of such cases, a conservative intervention offering equally good prognosis is always desirable. This case report describes the case of a 40-year-old male who was referred to the ITS dental college, Greater Noida. Patient came with the chief complaint of pain while chewing food in the lower right back molar region of the jaw since 1 month. On examination, teeth with concomitant open apices and root resorption was diagnosed and managed conservatively by (1) Placement of calcium hydroxide medicament (2) 1-step apexification for closure of the root apex by placing a preliminary barrier of absorbable collagen matrix and a secondary barrier of Bio dentine (Septodont, Saint-Maur-des-Fosses, France). One year follow-up revealed that the treatment outcomes, both clinical and radio graphic, were highly satisfactory. Bio dentine provides good inter facial adhesion and sealing with dentin attributed to its pro perty of hydroxy apatite crystal deposition at the material-dentin interface. The favourable clinical and radio graphic outcome in this case demonstrated that Bio dentine may be an efficient alternative to the conventi onal apexification materials and maybe used for complete obturation of the canal.

Keywords: Apexification, Bio dentine, open apex

Introduction

Chronic periapical pathosis associated with open apices has always been a dilemma situation for the endo dontists. Open apices are generally associated with arrested root development due to the history of trauma,

incomplete root maturation, or extensive root resorption of the apices (1).

Open apices along with the large chronic periapical lesions possesses several challenges such as an increased possibility of polymicrobial infections and/or resistant micro-organisms, risk of irrigants extrusion beyond the apex (2). Historically, the choice of treatment in such cases were surgical intervention and/or custom fills, but either option has its own associated drawbacks(1).With the inherent risks and considerations of the surgical interventions there is also an associated weakened walls present in the apical root, which elevates the possibility of shattering during retro cavity preparation and filling (2).

The greatest challenge faced when performing con ventional endo dontic treatment in teeth with open apices is the establish Ment of an apical seal. Apex i fication is the procedure to achieve apical closure in absence of a natural apical constriction (3).

Several formulations of calcium hydroxide including combinations with medicaments like 2% chlorhexidine or iodoform have been tried with the aim of combating resistant endodontic pathogens in large periapical lesions (4). But calcium hydroxide is known to induce a calcific barrier that is porous and weakens roots when placed for extended period of time.

Mineral trioxide aggregate (MTA) has been successfully considered as the gold standard in 1-step apexification during the past decade owing to their superior sealing ability, bio compatibility, regenerative capabilities, and antibacterial properties (5,6). The drawbacks include their discolouration potential, systemic effects and retreat ability following use as a root filling material. There has been a persistent search for improved bio compatible materials applicable to endodontic practice, such as calcium silicate cements to overcome the short comings of traditionally used calcium hydroxide paste and mineral trioxide aggregate (MTA) paste (7).

Bio dentine™, a bio ceramic material has been labelled as the "bioactive dentin substitute," possessing improved mechanical, physical, as well as handling properties comparable to those of MTA. Due to their bioactive nature, Bio dentine has the ability to form a hydroxy apatite layer between the obturating materials and root dentin, which reinforces the effect of complete obturation with these materials. In comparison to other calcium silicate-based cement-like MTAs, Bio dentine has three main advantages such as superior mechanical properties, a faster setting time (12 minutes only), and better handling characteristics (3).

The present case report demonstrates a one-year follow-up of a symptomatic previously RCT treated mandibular molar with an open apex associated with radio graphic periapical lesion with Bio dentine.

Materials and methods

A 40-year-old male with no relevant medical history presented in the department of conservative and endo dontics, ITS dental college, greater Noida, Uttar Pradesh. Patient complaint of pain on mastication in the lower right back molar region of the jaw since 1 month. Patient gave a history of root canal treatment wrt #47 one year back. The recurrence of pain was noted for the past 1 month however when the patient presented, he had severe continuous pain.

Sensitivity tests (heat, cold, and electrical pulp testing) of the tooth gave no response. The tooth was tender on percussion and slightly tender on palpation also. A pre-operative periapical radiograph of the tooth revealed root resorption and open apex chara cterised by a radio lucency wrt to the distal root.

Also evident was the poor obturation wrt to the mesial root canals. The apexification treatment with Bio dentine

was elected with the informed consent of the patient. It was decided hat surgery would be performed if endodontic treatment failed.

First appointment

Local anesthesia with 2% lignocaine was administered, and after isolation with a rubber dam, post endodontic restoration was removed followed by removal of gutta percha using GP solvent, and H file of # 20 no. was used to scrap off the possible remnants from the dentinal walls. Working length of each of the canals was taken. Biomechanical preparation was done till 20-6 % taper using the azure heat treated file system. The working length for distal canal was kept 1.5-2 mm short of the root resorption. The canal was irrigated with copious amounts of 2.5% sodium hypochlorite using ultrasonic activated irrigation. Calcium hydroxide (CH) paste was placed into the apical portion of canals with a lentulospiral as an intracanal medicament. The access cavity was closed with a cotton pellet and temporised. The patient was scheduled for a second visit after 1week for further treatment.

Second appointment

The patient experienced slight pain for 24-48 hours after the first visit and was asymptomatic after that till the second visit. After isolation with rubber dam, the temporary restoration and cotton pellet were removed from the access cavity. A copious amount of 2.5% sodium hypochlorite ultrasonic activated irrigation was carried out in order to remove the CH paste from the canals. A final rinse of 17 % EDTA was performed for 2 minutes. The canals were dried using the paper points. A small piece of absorbable collagen membrane (collacot) was placed at the apical portion of the distal canal. The membrane was introduced into the root canal and gently compacted by using hand pluggers slightly beyond the apex in order to achieve a matrix. Bio dentine was mixed according to the manufacturer's instructions. It was carried into the canal with an MTA carrier and condensed with the hand pluggers to form an apical plug. The rest of the canal was obturated with the same bio dentine material. Whereas, mesial canals were obturation using the gutta percha cones coated with AH plus resin sealer. The permanent restoration (bonded resin restoration) was placed after the entire obturation process is completed in the same appointment. The patient was advised an initial follow up after one week.

Follow up

At follow-ups performed at 1, 6, and 12months after treatment the tooth was asymptomatic, and no change in color of the crown was observed. The continuity in the periodontal ligament space with absence of periapical radiolucency was observed at 1- month, 6-month, and 12-month radiographs.

Discussion

Apexification is defined as a process of inducing a calcified apical barrier or continued apical development of an incompletely formed root in teeth with necrotic pulp. Teeth having concomitant open apices and large periapical lesions, especially those extending to cause cortical expansion or erosion of cortical plates, and further affected with inflammatory root resorption fit into a genre of complex endodontic cases often attracting surgical intervention. (8). However, surgical treatment should be reserved preferably as a second line of treatment and considered only when conservative treatment has failed to resolve the peri radicular pathosis (9). In the present case non- surgical intervention was choosen firstly.

In most apexification protocols involving human immature or mature permanent teeth with apical periodontitis, the placement of an apical plug is crucial for sealing and preventing bacterial leakage (10). Also,

the role of intracanal irrigation and placement of medication in addition to mechanical instrumentation cannot be understated. The intracanal disinfection protocol adopted here included an extensive irrigation with 5.0% sodium hypochlorite, an initial dressing of calcium hydroxide for 1 week chosen for its antibacterial and hygroscopic properties, neutralization of the acidic environment and activation of phosphatase enzymes (11,12).

Bio dentine is becoming the material of choice for apexification therapy because of excellent bio compati bility and sealing ability. It is a new bioactive dentin substitute cement, which is composed of powder that consists of tricalcium silicate, dicalcium silicate, calcium carbonate, calcium oxide, zirconium oxide, and CH. It has been developed as a permanent dentine substitute material whenever original dentine is damaged (13). Also, It has a shorter setting time of 12 minutes, as compared with that of MTA, which is 2 hours 45 minutes. In case of apexification, quicker setting time eliminates the need for two step obturation as with MTA, and reduces the risk of bacterial contamination (14).

The ability of calcium silicate to interact with distilled water leads to the setting and hardening of the cement. The powder is mixed with 5 drops of liquid and activated in the dental triturator for 30 seconds till a putty-like consistency is achieved (13).

Zanini et al (15) suggest that Bio dentine is bioactive because it induces differentiation of odontoblast-like cells and increases murine pulp cell proliferation and bio mineralization. Lee et al (16) suggested the use of Bio dentine as well as MTA and Bio aggregate as root-end filling materials because in contact with mesenchymal stem cells they induce osteoblast differentiation.

Bio dentine shows apatite formation after immersion in phosphate solution. The thickness of the calcium and silicon -rich layers increased over time, and the thickness of the calcium and silicon -rich layer was significantly larger in Bio dentine compared to MTA after 30 and 90 days. The higher calcium release from Bio dentine and the prominent uptake of calcium by adjacent root dentin also enhances its bioactive effect and periapical healing compared with MTA. These findings lead to the notion that apatite formation contributes to leakage reduction not only by filling the gap along the interface but also via dentine interactions such as intrafibrillar apatite deposition (17).

Placement of Bio dentine as apical plug is technique sensitive. Restricting the material to the confines of the root apex is crucial. Sealing material extruded peri apically may set before it disintegrates and gets resorbed. This might result in the persistence of the inflammatory process, which may complicate or even prevent repair of the tissue (18). To overcome such problems, Lemon in 1992 introduced the ‘internal matrix concept’ for treatment of root perforations. use of a sterile absorbable collagen membrane as an external matrix has been advocated to reconstruct the outer shape of root and facilitate the adaptation of the sealing material. This material absorbs moisture and expands and also has a haemostatic effect. The collagen membrane fully absorbs within 10 to 14 days allowing new bone to gradually fill the defect (19).

In the present case both clinical and radiographic evaluation were highly satisfactory with complete resolution of all clinical signs and symptoms. On the basis of sealing ability and bio compatibility, apexifi cation treatment with Bio dentine was brought to use in the present case report. However, long-term randomized

controlled trials with upto 3 years of follow up is required to validate these findings.

Conclusion

Single visit apexification with a novel bio compatible material like Bio dentine is a new boon in effective management of teeth with open apex. The positive clinical outcome in this case is encouraging for the use of Bio dentine in mature teeth with necrotic pulps and wide-open apices. However more clinical data is recommended to support the beneficial effects of bio dentine depicted in this study.

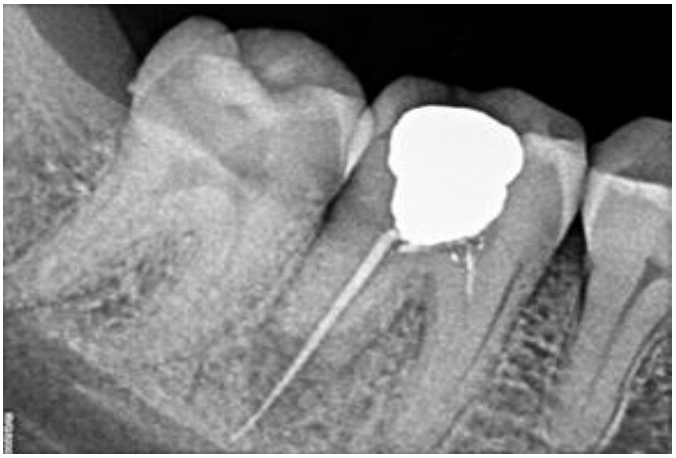

Figure 1: Preoperative radiograph showing periapical lesion and root resorption involving teeth # 47

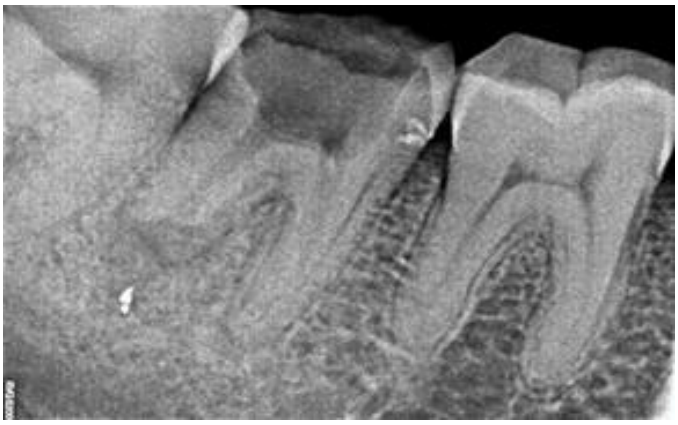

Figure 2: Radiograph showing an open apex after GP removal and an intracanal dressing extruding through the apex of tooth into the lesion present in tooth # 47

Figure 3: (A and B) Radio graph showing working length determination

Figure 4: Radiograph showing master cone and obturation wrt mesial canals present in tooth #47

Figure 5: Radio graph showing the apical barrier of collacot and completed obturation with Bio dentine wrt distal root of #47

Figure 6: A 1 - month follow up radiograph

Figure 7: A 6- month follow up radiograph

Figure 8: A 12-month follow-up radiograph

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