

# AMNION MEMBRANE MATRIX AND BIO DENTINE IN THE MANAGEMENT OF AN EXTERNAL APICAL ROOT RESORPTION

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## ABSTRACT

External apical root resorption results in blunting and shortening of roots with open apices that present a major challenge in obtaining a complete three-dimensional seal of the root canal system. In recent years the treatment option in the management of a case with external root resorption is the use of an apical barrier. This case report describes the novel use of amnion membrane matrix and Bio dentine as an apical barrier in the management of an apical root resorption case. Access opening was initiated followed by thorough cleaning and shaping of the root canals. Calcium hydroxide was placed for 2 weeks within the root canal as an intracanal medicament. In a subsequent appointment, an amnion membrane was placed at the root apex to serve as an internal matrix followed by a 5 mm apical plug with Biodentine. This was followed by post space preparation and placement of glass fiber post in the canal along with composite core build-up. Teeth were restored with full veneer porcelain fused to metal crowns. After eighteen months, there were no clinical signs or symptoms, and the formation of a calcific tissue apical to the Biodentine barrier. The favorable results, in this case, suggest that amnion membrane matrix and Biodentine plugs can be used to treat apical root resorption predictably.

**Key words:** Amnion membrane, External root resorption, Biodentine, Roots

## Introduction

External apical root resorption results in the loss of apical constriction. The main aim of treatment in case of an external root resorption is the eradication of microorganisms to ensure healing of the periapical area. This goal can be achieved by standard root canal treatment.

However, lack of an apical constriction can lead to difficulty in achieving an apical seal which becomes a major endodontic challenge. Thus, as an alternative to standard root canal therapy, apexification has been advocated in such cases.

Apexification is a procedure where there is continued root development of teeth with immature open apex by inducing a calcific barrier at the root end [1]. The first choice of material for apexification procedures is Calcium hydroxide [2]. Although this procedure is quite effective with favorable outcomes, it has several limitations a) The time for formation of apical barrier b) more no of visits c) Patient compliance d) risk of reinfection due to loss of coronal restoration e) fracture of tooth [3-5]. Moreover, this technique leads to the formation of “Swiss cheese” porous callus bridge [6]. Therefore, in an attempt to overcome these limitations, the concept of “one-step apexification” was introduced.

One-step apexification is a method of creating an artificial apical plug using a biocompatible substance that seal the root canal in a retrograde direction [7]. This approach has a distinct advantage in that it takes less time to treat and produces a superior apical seal [8-13].

The extrusion of these materials into the periradicular tissue, which prevents proper compaction, is a technical problem

connected with their insertion in cases with open root apices. Hence, the need for an apical matrix for controlled compaction of these materials to a desired level. Calcium hydroxide, hydroxyapatite, absorbable collagen, calcium sulfate, and autologous platelet-rich fibrin membrane have all been suggested in the literature as possible matrix materials [14-17].

In recent times, MTA has gained immense popularity for one-step apexification due to its superior sealing ability, biocompatibility, and antibacterial properties. However, its poor handling properties and extended setting time led researchers to develop a material with similar properties but better handling characteristics. This led to the invention of Biodentine (Septodont, Saint-Maur-des-Fosses, France), a novel calcium silicate-based material that retained the qualities and therapeutic applications of MTA while removing its unfavorable aspects.

Amnion-derived cells are multipotent in nature and contain a rich source of stem cells and growth factors that have been used in regenerative medicine. The amniotic membrane could be separated, sterilized, and stored for future use. Diño *et al.* [18] the amnion membrane acts as a biological matrix, allowing cells to migrate.

The use of amnion membrane as an internal matrix and Biodentine as an apical barrier is highlighted in this case report as novel non-surgical management of external apical root resorption.

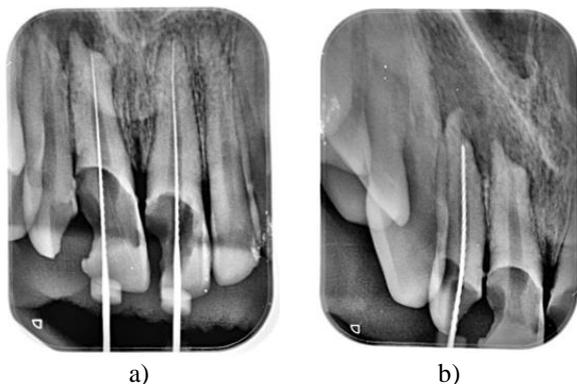
## Case presentation

A 20-year-old male patient presented to the Department of Conservative Dentistry and Endodontics with decaying

upper front teeth as his primary complaint. The patient had been through a traumatic event eight years prior. The patient had no prior medical conditions, medication allergies, or other severe dental issues. Intraoral examination revealed decay involving the cervical (class v) and proximal aspects (class IV) in relation to teeth #11, #12, and #21 (**Figure 1**). The involved teeth were not tender on palpation and percussion. Periodontal probing was within physiological limits, and the teeth were not movable. With electric pulp testing, no response was generated by the affected teeth (Parkell Electronics Division, Farmingdale, NY, USA). The radiographic examination revealed external apical root resorption in relation to teeth #11 and #12 (**Figures 2a and 2b**). A diagnosis of pulp necrosis with external apical root resorption was made based on the clinical and radiographic examination. In relation to teeth #11 and #12, the different treatment alternatives were discussed with the patient, and a clinical decision was made to place an apical matrix barrier in the form of an amnion membrane followed by Biodentine apical plug creation. For tooth #21, a standard root canal therapy followed by post and core was planned.



**Figure 1.** Preoperative image showing decay involving the cervical (class v) and proximal aspects (class IV) in relation to teeth #11, #12, and #21



**Figure 2.** a) working length determination of tooth 11,21. b) working length determination of tooth 12

Following the patient's informed permission, the decay was removed with a round carbide bur (MANI INC., Utsunomiya

Tochigi, Japan) and the teeth were isolated with rubber dams. An electronic apex locator was used to calculate the working length, which was then validated using radiography (**Figures 2a and 2b**). The root canal was cleaned and shaped with a #80 K-file (Dentsply Maillefer, Tulsa, OK, USA), and irrigated with a 3 percent sodium hypochlorite solution and saline alternatively.

The canals were dried with sterile paper points before an intracanal medicament of calcium hydroxide (Ultracal XS, Ultradent, South Jordan, USA) was placed. The access cavity was temporized with Cavit G. (3M ESPE, Seefeld, Germany). After 2 weeks, the patient was summoned back and the medication was physically removed with hand H-files (Dentsply Maillefer, Tulsa, OK, USA) while rinsing with alternate solutions of 3 percent sodium hypochlorite and 17 percent ethylenediaminetetraacetic acid (Prevest Denpro Ltd., Jammu, India). The canal was then rinsed with saline for the final time. Amnion membrane was injected through the root canal and gently compacted with pre-fitted hand pluggers slightly beyond the apex to achieve a matrix after the canal was dried with sterile paper points.

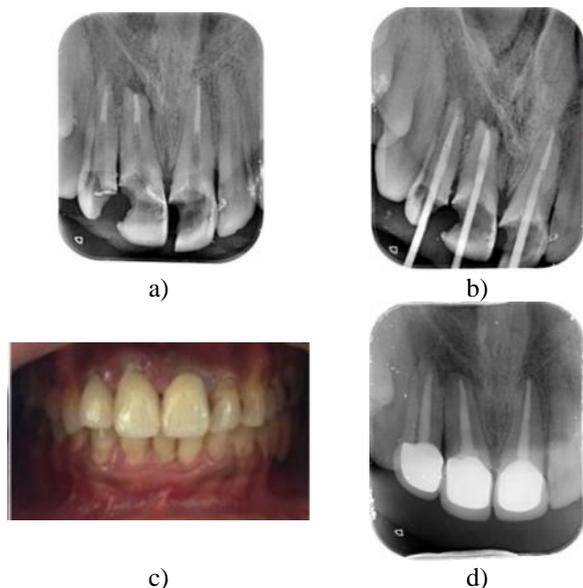
Mothers who consent to donate their amnion and related tissue during elective cesarean section surgery can acquire amnion allograft by following the Tissue Bank's procurement, processing, and distribution criteria (Tata Memorial Hospital, Mumbai). Various tests specific antibodies testing for HIV, Hepatitis B, and C, and syphilis are performed as safety measures for serological infectious diseases. After the amnion and chorion tissues have been isolated from the material tissue, the amnion is sanitized, dehydrated, and perforated to be employed as a barrier.

With the use of a messing gun, Biodentine, a new dentin alternative, was introduced within the root canal and condensed against the amnion matrix using pre-fitted hand pluggers. A 5 mm plug of Biodentine was obtained, which was confirmed radiographically (**Figure 3a**). After 15 minutes, a hand plugger was used to confirm the set of biodentine.

In relation to tooth #21, conventional obturation was carried out by lateral compaction of gutta-percha cones used with AH plus resin sealer (Dentsply DeTrey, Konstanz, Germany). System B plugger (Kerr Dental, Orange, CA, USA) was then used to create an apical plug of GP, measuring 6mm in thickness.

Post and core was planned for all the involved teeth. RelyX™ glass fiber post (3M ESPE, Seefeld, Germany) was chosen as this post system doesn't require any pre-treatment of the canal (i.e. etching, priming, and bonding) as well as of the post (i.e. Silanating or roughning), thereby shortening the chairside time. Size 2 post (apical end diameter of 0.80mm and coronal end diameter of 1.60mm) was selected. The post was cemented using RelyXTM Unicem, a self-adhesive universal resin cement that was light-cured for 40 seconds. (**Figure 3b**). Core was built using direct composite resin (Gradia Direct, GC Corporation, Tokyo, Japan). In the following appointment, a full veneer PFM crown was used to restore the teeth (**Figure 3c**).

In the two year follow up, the biodentine barrier which was placed at the apical portion showed a layer of calcific tissue which enhanced the form function and aesthetics of the tooth. (Figure 3d).



**Figure 3.** a) Radiograph showing a 5mm biodentine plug at the apical portion. b) Radiographic image showing the placement of fiber post. c) Postoperative Image. d) Radiographic image of 2 years follow up which shows the formation of the calcific barrier in the apical end

## Results and Discussion

One of the significant limitations of the tooth with open apex is the extrusion of root filling material beyond the apex. The use of an internal apical matrix prevents material from extruding into the periapical tissues and permits periodontal tissues to respond favorably.

In the present case, a novel material, amnion membrane, was used as an internal apical matrix. Although, it has been used extensively in periodontics for guided tissue regeneration and root coverage procedures [19], its application in endodontics has not been documented. Several case reports have documented the use of autologous platelet-rich fibrin as an internal matrix [20-22]. Despite its positive therapeutic outcome, using autologous tissue in cases of resorption has a few downsides. Because autogenous tissue is in short supply, obtaining it increases patient morbidity while also extending the process.

Because amniotic epithelial cells are immunologically inactive, the danger of rejection or immune reaction is reduced [23].

The potential of the amniotic membrane to form a physiologic barrier with the tissue in contact, thereby reducing the bacterial infection. Amnion's capacity to attenuate the host immunologic response via mechanisms such as localized reduction of polymorphonuclear cell migration has been reported in various investigations [24]. It

acts as a biological matrix, allowing cells to migrate more easily and providing a plentiful supply of stem cells and growth factors [25].

For one-step apexification procedures, MTA has become the most favored material. MTA, on the other hand, has a long setting time, poor handling properties, low compression resistance, limited flow capacity, weak resistance to washout before setting, the potential for tooth discoloration, and the presence and release of arsenic [26]. Because its mechanical properties are equal to those of natural dentine, Biodentine surpasses MTA. Other sealants are less stable, less soluble, easy to handle, take less time to set, form a tighter seal, and have higher radiopacity [27].

The surgical outcome of the present case was deemed a success clinically and radiographically due to the nonappearance of clinical signs and symptoms and the establishment of a layer of calcific tissue apical to the Biodentine barrier over the 2-year follow-up period.

However, further research is needed, including long-term follow-up on a larger number of teeth using standardized techniques.

## Conclusion

The positive clinical outcome, in this case, shows that external apical root resorption cases can be managed predictably using the novel amnion membrane matrix and Biodentine, provided all the safety criteria are followed in the application of this novel biological membrane.

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**Ethics statement:** None

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