Case Report

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A CONTEMPORARY APPROACH FOR INTRARADICULAR REHABILITATION OF NON-VITAL IMMATURE TEETH WITH BLUNDERBUSS CANALS

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ABSTRACT:

The success of endodontic treatment is based on the complete debridement, thorough disinfection and obturation of the root canal space with all aspects equally important. Trauma or caries of the tooth during the development of root can lead to incomplete apical closure in a mature tooth. Such teeth pose a special challenge to the endodontist and require a customized treatment plan. Various materials and treatment modalities have been described to treat the teeth with incompletely formed apices. The present case report describes an apical plug technique, where an apical matrix is placed followed by the placement of mineral trioxide aggregate (MTA) as artificial root end barrier and obturation done using intracanal composite resin. The placement of an apical matrix acts as a base on which the MTA apical plug can be placed thereby preventing the extrusion of the material into the periapical area.

Key words: Apexification, Apical plug technique, Blunder buss canal, Calcium hydroxide, Mineral Trioxide Aggregate, Open apex

INTRODUCTION:

The success of root canal treatment depends on elimination of root canal contents, proper cleaning and shaping followed by hermetic sealing of the root canal system. In teeth with incomplete root development as a consequence of pulp necrosis through trauma or caries, the incomplete apical closure, thin dentinal walls are more prone to fracture and lack of apical constriction makes the complete debridement and control of obturating material difficult [1]. According to Arnaldo Castalleucci [2], when the foramen is very wide and with canal walls being parallel or even divergent corono-apically, depending on the degree of maturity, he referred such root canals as “Blunderbuss Canals”. The creation of an apical barrier with hard tissue deposition is necessary to permit adequate filling. According to T.B. Kandos [3], the problems encountered during the treatment of teeth with immature apices include:

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incomplete debridement due to the wider apical diameter, lack of natural apical constriction, thin dentinal walls which are prone to fracture. To overcome these problems, apexification or root end closure technique has been advocated.

Apexification can be defined as a method to induce a calcified barrier in a root with an open apex or the continued apical development of teeth with incomplete roots and a necrotic pulp [4]. Traditionally, multiple and long-term applications of calcium hydroxide mixed with different vehicles was used to create an apical barrier to aid the obturation [5,6]. The long time span and re-infection due to temporary seal with calcium hydroxide has led to the use of MTA. Alternative treatment modalities used to treat teeth with open apices are Custom made roll cone technique, short fill technique, Obturation done with guttapercha and sealer with periapical surgery, Instrumentation only, Induction of periapical bleeding with instrumentation.

Mineral Trioxide Aggregate (MTA) has shown promising results in sealing immature teeth with wide open apices. It facilitates periradicular healing by inducing hard tissue formation [7]. The major problem in blunderbuss canals is adequate condensation of MTA, as the material may get extruded beyond the apex. Therefore, an apical matrix is used which acts as a base on which MTA is condensed. Various materials have been tried as apical matrix, which include tricalciumphosphate [8], collagen calcium phosphate [9], osteogenicprotein – 1, bone growth factor and oxidized cellulose [10], proplast, barium hydroxide[11], true bovine bone ceramics, and dentin chips [12]. Bargholz C, has proposed ”Modified matrix concept” for repair of perforation using resorbable collagen membrane as a matrix followed by condensation of MTA [13]. The aim of the present case reports is to highlight the non-surgical management of teeth with blunderbuss canals using an apical matrix and MTA to promote periapical healing.

CASE DETAIL:

Case Report 1

A 15 year old female patient reported to the department of Conservative Dentistry and Endodontics, with a chief compliant of discolored permanent maxillary right central incisor (#11) from past 3 years. History revealed that the patient had suffered trauma around the age of 10 years. At the time of presentation she was asymptomatic but gave history of swelling and pus discharge which subsided without any medication. Her medical history was non-contributory. Clinical examination revealed discolored permanent maxillary right central incisor (# 11) which showed no tenderness on percussion and palpation. Radiographic examination revealed an immature tooth with a wide open apex and periapical radiolucency approximating the tooth [Figure.1]. The tooth gave no response to thermal and electric pulp tests. Root canal treatment using apical matrix placement with MTA apexification followed by intracanal composite resin obturation was planned.

After rubber dam isolation, a conventional endodontic access opening was done under local anesthesia and initial working length was predicted by using paper point method. Then radiograph was taken and working length was confirmed. Gentle instrumentation was done with #80 H-file in circumferential manner. Irrigation with 3% sodium hypochlorite was done throughout the shaping and cleaning procedure. The canal was dried with multiple absorbent points followed by an intracanal dressing with calcium hydroxide paste. Access was sealed with Cavit-G and the patient was recalled after one week.

One week later, the tooth was again isolated under rubber dam and the canal was thoroughly irrigated using saline and 3% sodium hypochlorite, to wash out any remnants of calcium hydroxide dressing and 17% liquid EDTA smear clear (Sybron Endo, CA,USA) for removal of smear layer. After confirming the dryness of canal, collagen membrane (Perioglas GTR, Eucare pharm.) was cut into small pieces and packed against the bone and was pushed beyond the apex into the bony space formed due to the periapical lesion in order to achieve a base for the placement of MTA. A thick mixture of white MTA (Pro-root MTA^{TM} Dentsply Tulsa) was prepared and carried into the canal with the help of messy gun and packed to form an apical plug of approximately 4mm. Excess material was cleared from the walls. Moistened guaze was placed in the canal and the access cavity was sealed using glass ionomer cement (Fuji, GC corporation, Tokyo,Japan). The patient was recalled on next day and the moist gauze was removed and a plugger was used to check the consistency of the MTA and to examine if the material was thoroughly set. Then the canal was etched with 38% phosphoric acid (Etch-Rite; Pulpdent Corp., Watertown, MA), rinsed, dried, and lightly coated with a dual-cured dentin bonding agent (All-Bond 2; Bisco, Schaumburg, IL) using a microbrush (Bisco). The canal was then backfilled with a flowable dual-cured composite,(BISFIL 2B; Bisco), delivered with a C/R EZ Centrix syringe (Centrix, Shelton, CT) through a needle tube (Centrix) from the MTA barrier to within 2 mm of the cavosurface margin. Post obturation radiograph confirmed the completion of endodontic therapy (Figure.2). A 6 month follow up radiograph revealed decrease in apical radiolucency. At 1-yr recall, the patient was completely asymptomatic and follow up radiograph revealed complete resolution of the periapical lesion [Figure. 3].

Case Report 2

A 17 year old male patient reported to the department of Conservative Dentistry and Endodontics, with a discoloration and crown fracture of permanent maxillary left central incisor (#21). The patient reported that the trauma occurred around the age of 10 years and no treatment had been performed. His medical history was non-contributory. Clinical examination revealed crown fracture exposing pulp of maxillary let central incisor (# 21).Grade I

mobility was seen. The tooth failed to respond to thermal as well as electric pulp test. Radiographic examination revealed immature tooth with open apex and slight periapical radiolucency in relation to #21[Figure 4]. Root canal treatment using apical matrix placement with MTA apexification followed by intracanal composite resin obturation was planned.

Local anesthesia was administered and a conventional access opening was done under rubber dam. Working length was determined as in the above case followed by gentle instrumentation with # 80 H-file in a circumferential manner along with continuous irrigation with 3% sodium hypochlorite. Canal was dried and a intracanal calcium hydroxide dressing was placed. Patient was recalled after 1 week. Thorough irrigation was carried out to remove any remnants of calcium hydroxide. After confirming dryness of canal, the apical matrix was created using calcium phospho-silicate bioactive glass graft material (Perioglas–Bioglass bone graft particulate, Novabone Products, LIC). The powder was mixed with saline and placed beyond the apex into the bony space using hand plugger (Dentsply). Then a thick mixture of white MTA (Pro-root MTA^{TM} Dentsply Tulsa) was carried into canal with the help of messy gun and packed to form an apical plug of approximately 4mm[Figure 5]. Over this moist guaze was placed and access cavity sealed. Next day, the moist gauze was removed and checked for consistency of MTA. As in the case report 1, the Canal was dried and after the etching, bonding agent application, intracanal composite resin backfill was done. Post obturation radiograph confirmed the completion of the endodontic therapy [Figure 6]. Splinting was done for 1 month. A 6 month follow up radiograph revealed decrease in apical radiolucency. At 1-yr recall, the patient was completely asymptomatic and follow-up radiograph revealed resolution of the periapical lesion [Figure.7].

DISCUSSION:

Successful apexification depends on the formation of a hard tissue barrier by cells that migrate from the healing periradicular tissues to the apex and differentiate under the influence of specific cellular signals to become cells capable of secreting a cementum osteodentin organic matrix [14]. For many years, the placement of calcium hydroxide within the root canal space has been the standard treatment option to stimulate apical closure in a developing tooth with a necrotic pulp. Despite its popularity for the apexification procedure, calcium hydroxide therapy has some inherent disadvantages that include variability of treatment time (3–21 months), unpredictability of apical closure, difficulty in patient follow up and delayed treatment [15,16]. In addition, the canal is susceptible to reinfection because it is covered by a temporary seal and also the thin dentinal walls were susceptible to fracture during treatment. Therefore, the search continues for procedures and materials that may allow for continued apical closure in teeth with immature apices. An alternative method to long-

term apexification procedure is to use an artificial apical barrier that allows immediate obturation of the canal. MTA may be an appropriate alternative for performing this procedure with predictable results. MTA has an ability to facilitate normal periradicular architecture by inducing hard tissue barrier with good sealing ability [17], good marginal adaptation, a high degree of biocompatibility and a reasonable setting time.

Although earlier studies recommended the use of MTA for apexification, it has been shown to be strongly related to the extrusion of the material [18]. A large volume of the extruded material may set before it disintegrates and get resorbed. This might result in the persistence of the inflammatory process, which may complicate or even prevent the repair of the tissue [19,20] Using a matrix avoids the extrusion of the material into the periodontal tissues, reduces leakage in the sealing material and allows favorable response of the periodontal tissues.

In the present cases, combination of calcium hydroxide and iodoform (Metapex) was used as intracanal medicament to make the canal dry and free from infection. In case report 1, collagen membrane (Periocol GTR) was used as an apical matrix. It is an orange brown type – I collagen membrane derived from fish sources and available in various dimensions. It is gamma sterilized. It is radiolucent, non-toxic, non- allergenic and non- immunogenic and overall biocompatible. It is used in the management of intrabony defects.

In case report 2, calcium phospho-silicate bioactive glass graft material (Perioglas– Bioglass bone graft particulate, Novabone Products, LIC) was used as an apical matrix. It is a synthetic absorbable osteoconductive bone graft substitute composed of a calcium phospho-silicate bioactive glass, Bioglass. The device is in a particulate form of a size range 90-710µm. because of its, osteoconductive properties it could have promoted the healing in the second case. Both the collagen membrane and graft material as apical matrix, created a suitable base against which the compaction of MTA was done thereby minimizing the extrusion of material into the periapical area.

In the present case reports, Intraradicular rehabilitation was done using intracanal composite resin. In teeth with wide open apex, the thin dentinal walls are seen and they may be too weak to withstand the normal forces of mastication which are more prone to fracture. Composite resin materials bond to dentin and internally rebuild the root, providing dimensional and structural reinforcement [21].According to a study conducted by Robert Lawley et.al, demonstrated that a flowable resin-bonded composite for intracanal obturation against an MTA apical barrier significantly increased the fracture resistance of the thin dentinal walls. A Centrix syringe (Centrix) with a needle tube dispenser allowed consistent intracanal delivery of a flowable dual cure

composite (BisFil 2B; Bisco).Internal bonded composite, provided an adequate apical seal, with 89% of the barriers resistant to bacterial leakage over a 90-day observation period [22]. In addition, 4 mm of MTA allowed an adequate thickness of composite to be bonded against, to provide a significant resistance to fracture.

CONCLUSION:

To conclude, placement of an apical matrix followed by MTA apical plug and obturation with an internal bonded composite resin appears to offer a favorable prognosis. The advantages of such a procedure lie in the potential to promote faster periapical healing, prevent the extrusion of the MTA and internal rehabilitation of thin dentinal walls in blunderbuss canals.

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FIGURES:

Figure: 1: Pre-operative

Figure: 2: Post Obturation

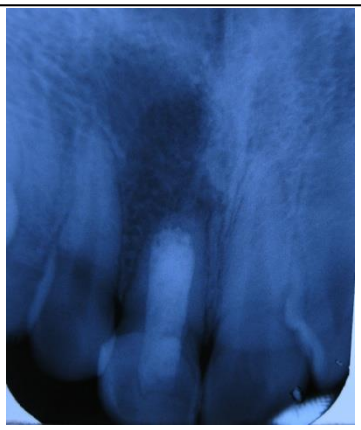

Figure: 3: 1 year follow up

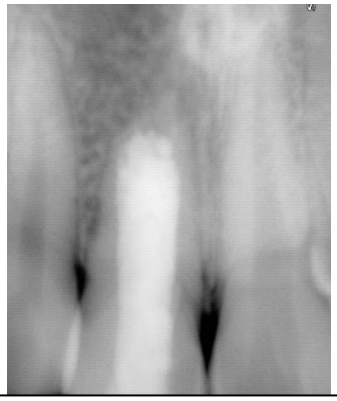

Figure: 4: Pre-operative Radiograph

Figure: 5: After placement of Apical Matrix and MTA

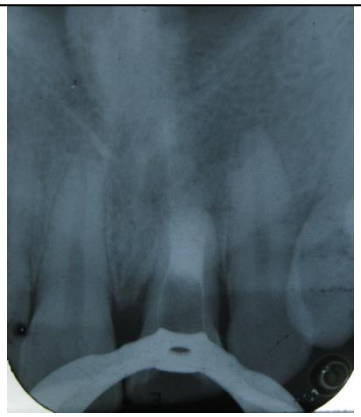

Figure: 6: Post Obturation Radiograph

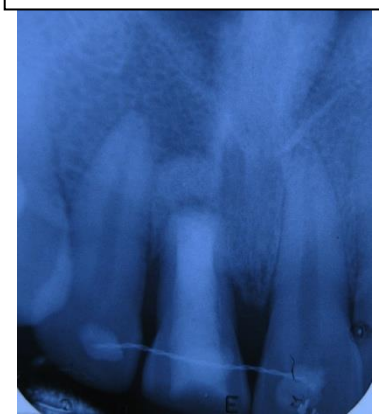

Figure: 7: 1 year Follow-up radiograph