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OPEN APEX MANAGEMENT WITH SINGLE VISIT MONOBLOC MTA APEXIFICATION: A CASE REPORT

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ABSTRACT

Trauma during tooth development is the major cause of incomplete root development ultimately leading to open apex and periapical infections subsequently. A single visit apexification is noninvasive method of apical barrier placement that facilitate gutta percha placement in these canals. The case discusses a single visit procedure for apical barrier using biomaterial MTA minimizing patient visits and time. The method has been utilized following which a coronal barrier of glass ionomer barrier for subsequent bleaching procedure is adapted in the present case managing a severely discolored anterior teeth in the aesthetic zone. The procedure was followed by a ceramic laminate veneer as the final restoration.

KEYWORDS: Open apex, single visit monobloc, ceramic veneers, bleaching resistance.

INTRODUCTION

During root development an incidence of trauma ceases its completion.[1] According to FS Weine, an open apex or incomplete rhizogenesis is the absence of sufficient root development to provide a conical taper to the canal and such canals are identified as blunderbuss canal (a wider apical canal than coronal). Morse et al. described a one visit or single visit apexification as condensation of a biocompatible material into the apical end of the root canal[2] A few among the various causes of open apex are: trauma, chronic periapical periodontitis that leads to apical resorption, resorption due to trauma, loss of apical constriction during mechanical debridement, apicoectomy without use of root-end filling materials and also horizontal root

fracture[3,9,10] Apexification is regarded as the last resort in immature permanent teeth that has lost its vitality.[4] It is indicated for teeth with open apices and thin dentinal walls where in standard instrumentation techniques cannot create an apical stop to facilitate effective root canal filling. These immature teeth pose numerous challenges like, wide apex and lack of proper apical stop to resist extrusion of the material into periapex, thin dentinal walls susceptible to fracture, attainment of a proper apical seal to resist leakage etc. The above issues can be tackled by stimulating the formation of hard tissue barrier which allows optimal filling and subsequent reinforcement of the weakened root against fracture during and after apexification procedure. The time required for Barrier formation is influenced by several factors such as opening of the apex, frequency of intracanal medication replacement, age of the patient and the presence of periapical radiolucency.

Traditional multiple-visit apexification treatment with the use of calcium hydroxide (CH) as intracanal medicament takes a minimum time period of 3- 18 months.[5] The frequency of changes of CH from the root canal is another controversial topic. This long duration of treatment is usually not favored by most patients which paved way to bioactive materials like MTA, Biodentine with shorter treatment times. Majority of immature teeth with open apices show periapical lesions of varying sizes and duration complicating the choice of the apical barriers.

Mineral trioxide aggregate (MTA) as an artificial apical plug for the treatment of teeth with open apex was proposed by Torabinejad and Chivian. MTA has the main advantages of inducing a hard tissue barrier in contact to its surface and it sets in presence of moisture, treatment can be completed in a single visit or in multiple visits with the use of CaOH as intracanal medicament. Other biomaterials like Biodentine and calcium-enriched mixture (CEM) have also been used as artificial apical barriers in cases of pulp less teeth with open apex.[6] Regardless the type of apexification, the type of apical barrier, the number of visits, the use of intracanal medicaments and its frequency of change, apexification procedures tend to have favourable clinical outcomes.[3]

Ceramic laminate veneers are minimally invasive methods of restorations in various clinical situations. A classification of their indication was suggested by Magne and Belser is given in Table1.[7]

Table 1.

Type i	**Whitening resistant teeth**
Type i a	*Grade ii and iv discoloration from tetracycline*
Type i b	*Lack of response to external or internal bleaching*
Type ii	**Important morphological changes**
Type ii a	*Conoid shaped teeth*
Type ii b	*Closing diastemas and interdental triangles*
Type ii c	*Increasing length and incisal prominence*
Type iii	**Extensive restorations**
Type iii a	*Extensive coronal fractures*
Type iii b	*Extensive loss of enamel due to erosion and wear*
Type iii c	*Acquired and generalized malformations*

A comparison of physical properties of various material to substitute enamel was compared which showed ceramics as the most suitable material so far. (Table 2). This case combines MTA monobloc apexification and ceramic veneers as final restoration in severely discolored tooth resistant to bleaching.[8]

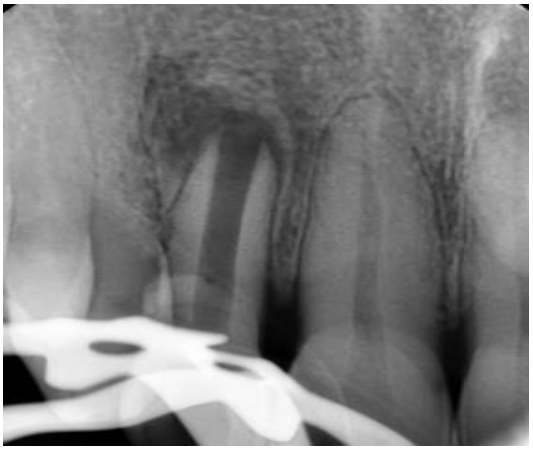
Table 2.

	Elastic Modulus (GPa)	**Knoop hardness** (Kg/mm^2)	**Linear TCE** 20^0-50^0 ($x\ 10^6/c^0$)	**Thermal Conductivity** ($Cal/sec/cm^2(c^0/cm)$)	**Strength (Mpa)**	
					Tensile	Compressive
Dentin	13.2 – 18.6	68	10-15	0.0015	98	297
Composite	4.5-20.1	22-80	25-68	0.0025	34-62	200-345
Enamel	83.0	343	10-15	0.0022	10	400
Ceramic	64-400 (70-96 feldspathic, lithium disilicate)	460	8-13.5	0.0025	40	150

CASE REPORT

A male patient aged 45 reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of discoloured maxillary right lateral incisor. The medical history was non-contributory. The history of the presenting complaint revealed an incidence of trauma 30 years back. The patient was asymptomatic since then but there was progressive discoloration. Vitality tests responses were negative which indicated a nonvital necrosed pulp tissue. Routine radiographs were advised which revealed a diffuse periapical lesion associated with an open apex in relation to.[12] A nonsurgical management of the case was agreed upon after informed consent from the patient.

Pre-operative photograph



Pre-operative radiograph

After rubber dam isolation, access opening was done and working length was determined 2 mm short of the apex, to prevent injury to the apical tissue Gentle circumferential filing was performed with minimal dentin removal using #80 H file and a minimally invasive biomechanical preparation and NaOCl irrigation was completed. In the same appointment intracanal CaOH dressing was placed for a period of 1 week to neutralize the pH of the periapical tissues and the cavity was temporized during this period. On next visit the CaOH was removed, canal was irrigated with 2% chlorhexidine and saline. After the canals were dried with absorbable paper points, MTA was mixed and placed inside the canal using plastic filling instruments and with suitable pluggers it was condensed in the entire canal length except for 2 mm apical to CEJ required for GIC barrier. GIC barrier of 2 mm was placed in the same appointment after 45 minutes with adequate space for bleaching agent the cavity was temporized. After a week an intracoronal bleaching was attempted with sodium perborate and 30% hydrogen peroxide mixture for a period of 1 week. Since this bleaching did not show any significant results even after two sittings, a ceramic veneer was planned as the final restoration which the patient agreed upon. The access cavity was restored with composite, shade was selected, tooth preparation was done and impressions were made for veneer fabrication. A ceramic veneer of suitable shade was cemented using resin cement as the final restoration. Follow up for 6 months was done which revealed uneventful healing.

INTRAOPERATIVE PICTURES

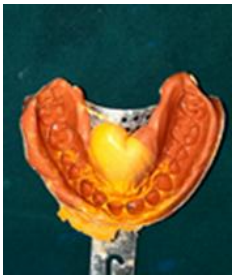
POST- OBTURATION RADIOGRAPH

POST BLEACHING PHOTOGRAPH

SHADE SELECTION

TOOTH PREPARATION

IMPRESSION



IMMEDIATE POSTOPERATIVE

1 YEAR FOLLOWUP PHOTOGRAPH **1 YEAR FOLLOW UP RADIOGRAPH**

DISCUSSION

Root development and apical closure takes a minimum period of three years after eruption. The maxillary lateral incisors eruption sequence reveals age range of 8-9 years for eruption and a period of three years post eruption for root completion. Any trauma during this time period result in incomplete root formation and apical closure resulting in open apex. Here the patient had a history of trauma around the time of root completion which might have resulted in open apex.[20] The main goals of apexification are the resolution of clinical signs and symptoms, radiographic resolution of lesion and induction of a calcified tissue barrier at the apex.

Use of artificial barriers can be completed in one visit where biomaterials like MTA, Biodentine or CEM can be placed apically to create an artificial seal that facilitates the compaction of gutta-percha. Hard tissue barrier is formation at the apex after the placement is not the primary goal of this technique but creation of a biological closure of the apex which is the reason for shorter time periods.[13,14]

The treatment can be finished in one visit without the use of an intracanal medicament or in multiple visits with the use of medication.[12,15] Studies have reported that there is no difference in clinical outcomes between one-visit and two-visit root canal treatment of teeth with pulp necrosis and periapical lesion. CaOH was used as intracanal medicament in apical plug apexification procedures in the majority of them it was left in the root canal for up to 3 weeks. Long periods were avoided because delay in placement of the permanent coronal restoration increases the risk of microleakage and tooth fracture and prolonged contact of CaOH with the root dentine possibly affects its biomechanical properties[16,17] The entire canal was obturated with MTA to facilitate complete biological seal to prevent microleakage and also to facilitate fracture resistance as shown in many studies. This MTA Monobloc

obturation is a variation of primary monobloc obturation[18,19,20] Few disadvantages of MTA as obturating materials are: difficulty in placement in curved canals and elective removal after placement, slow setting time (initial set 2.5–4.0 hours, complete curing -21 days) and high cost.[21]

Glass ionomer is an effective intracanal barrier to prevent coronal microleakage with proven antibacterial properties. The placement of conventional Glass ionomer after 45 minutes was favoured to complete final restoration in single visit without loss of strength nor detrimental effects on properties.[22]

According to classification of indications of ceramic veneers by Magne and Baiser, the above case belongs to is a Class1B which indicates a case non-responsive to externa/internal bleaching.[23] Restorative treatment was completed with shade matched ceramic veneers as it had discoloured but intact surfaces which showed success during the follow up period.

CONCLUSION

Treatment strategy for teeth with open apices depends on individual case and operator expertise and handling of various materials as concluded from this case of infected lateral incisor with open apex which showed successful outcomes both clinically and radiographically. Further studies with longer duration are necessary to provide more information about the use of MTA monobloc obturation for non-surgical treatment of infected necrotic teeth with open apices.

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