Journal of Environmental and Applied Bioresearch
Published online Oct 01, 2015 (http://www.scienceresearchlibrary.com)

ISSN: 2319 8745
Vol. 03, No. 04, pp. 218-222

Research Article **Open Access**

REGENERATIVE MANAGEMENT TECHNIQUE OF BILATERAL DENSE EVAGINATUS BY THE PROCESS OF REVASCULARIZATION

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Received: June 06, 2015 / Accepted : June 12, 2015

Abstract

Dens evaginatus is a developmental anomaly of tooth characterized by presence of a tubercle like projection from the tooth surface most commonly giving the form of a cusp. It comes under significant clinical consideration because of difficulty in diagnosis and having the chance of pulpal involvement after wearing off. The further consequences of a broken dens evaginatus can be pulp necrosis followed by formation of periapical pathology. There are several treatment options for this clinical entity but the treatment modality depends on the tubercle integrity, status of pulpal health and stage of root development of the involved tooth.

Method:

Here a case of broken dens evaginatus is reported with a large periapical lesion on both sides of mandibular first premolar having a wide open apex. For treatment, we opted the process of revascularization because it supports the physiological regeneration of periapical tissue and even helps in root completion.

Result:

At two years postoperative recall examination, the involved tooth was found completely asymptomatic and radiographically the periapical lesion was fond to be healed. Radiographic confirmation was also evident for root completion and thickening of the lateral dentinal wall.

Conclusion:

In this present case, we have discussed a case of Dens evaginatus that itself has some diagnostic dilemma along with its most physiologic form of a treatment option that has ultimately resulted in an excellent prognosis of the case.

Keywords: Dens evaginatus, Periapical lesion, Premolar, Revascularization.

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Introduction

Dens evaginatus is a developmental anomaly most commonly presented as tubercle or protuberance from the involved tooth consisting of outer enamel covering, dentinal core and most of the time an extension of pulp tissue (Sharma 2009). It most commonly involves the mandibular premolars (Ohlers1967) 5 times more than the maxiilary premolars (Echeverri. 1994) but it can also be present in maxillary or mandibular anterior teeth (Dankner, 1996). There are various synonyms for this entity like interstitial cusp(Yumikura,1963) tuberculated premolar , odontoma of axial cone type(Ohlers, 1956) evaginated odontome (Law,1956), occlusal anomalous tubercle(Merill,1964). The term evagination means a nodule or tubercle that is shaped as a cylindrical cone with a sharp point (Ferraz,2001). According to Merril the evaginations on the tooth can be divided into two groups: 1) nodule originating from the lingual crest of the buccal cusp and 2) nodule originating from the middle of the occlusal surface and commonly obliterates the central sulcus . When dens evaginatus involves the premolar tooth arising from the occlusal surface in between the two cusps, it comes under the 2nd category and named as Leong's premolar after the name of O.Leong who first described it in the Malayan Dental Association in 1946(Ngeow,1998). Dens evaginatus is most commonly found to be extended from the occlusal surface making them more prone to fracture leading to pulpal exposure (Tsurumachi, 2009). There are various treatment modalities for this entity, but the treatment option is entirely dependent on the condition of the tubercle, the stage of root development and even the extent of the periapical lesion. The treatment procedure becomes more complicated in case of an incompletely formed root with immature apex and in this scenario apexification or apexogenesis can be the treatment of choice (Levitan,2006). Here in this article a case of dens evaginatus is reported in both the mandibular first premolar with large periapical lesions that has been managed with nonsurgical revascularization procedure and in result complete resolution of the periapical lesion was found with appreciable amount of root formation.

CASE DESCRIPTION:

A 15 year old female patient was reffered to the Department of Conservative Dentistry for the treatment of 35 and 45 complaining of recurrent pain in both the teeth. Careful examination reveals the presence of slightly worn off Dens evaginatus with a pinpoint hole in the tubercle in both the teeth (Figure 1). In the present case, the patient was young and radiographic evaluation of both the mandibular 2nd premolar showed incomplete root formation with large periapical lesion (Figure 2, Figure 3). For the endodontic management of the teeth, apexification was preferred because we wanted maturogenesis of both the teeth. Before starting the procedure, patient was explained all available treatment options. She was explained all risks and benefits of revascularization. The patient did not receive local anesthesia since the teeth were nonvital.

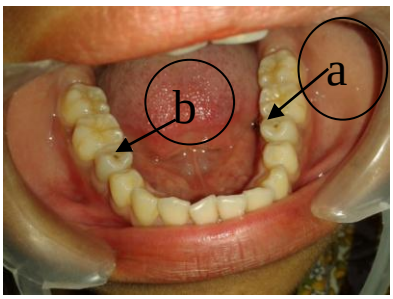

Figure 1: Dens evaginatus with a pinpoint hole in the tubercle in both 35 (a) and 45 (b).

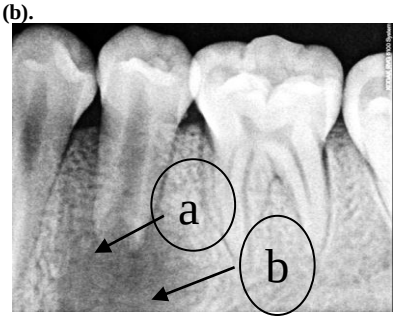

Figure 2: 45 presented with incomplete root formation and wide open apex (a) . Large periapical lesion in relation to 45 is also evident (b).

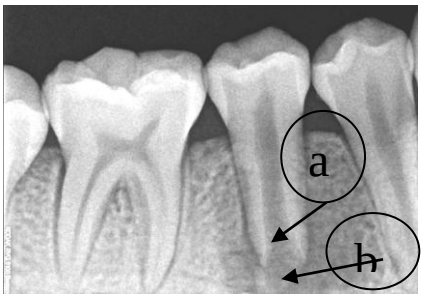

Figure 3: 35 presented with incomplete root formation and wide open apex (a). A Large periapical lesion in relation to 45 is also evident (b).

A rubber dam was placed and a conventional endodontic access opening was made with the help of Endo Access bur No. A 0164 (Dentsply Maillefer, Ballaigues, Switzerland). The conventional access cavity was enlarged to correspond with the large pulp cavity with the help of slow speed diamondKGS3203 (Dentsply Maillefer, Ballaigues, Switzerland). After getting access to the root canal system of both the mandibular 2nd premolars, foul smelling necrotic tissue was found in the root canals. The canals were then copiously irrigated with 20 ml of 3% sodium hypochloride solution (Novo dental products PVT .LTD, Mumbai) followed by 20 ml of normal saline. To prevent further weakening of the thin, fragile root dentinal walls, minimal instrumentation of the root canal was done. A sterile cotton pellet was placed in the pulp chamber, and the access cavity was sealed with a temporary restorative material (Cavit-G, 3M ESPE, St Paul, MN, USA).

The patient was recalled after 3 days and the root canal were copiously irrigated with 20 ml of 3% sodium hypochloride and 20 ml of normal saline. Working length was estimated with the help of intraoral periapical radiograph (IOPA) (Figure 4, Figure 5). The canal system were dried with sterile paper points (Dentsply Maillefer, Ballaigues, Switzerland) and triple antibiotic paste containing Minocycline, Ciprofloxacin and Metronidazole were packed 1mm short of the radiographic apex. The access cavity was sealed with a temporary restorative material (Cavit-G, 3M ESPE, St Paul, MN, USA).

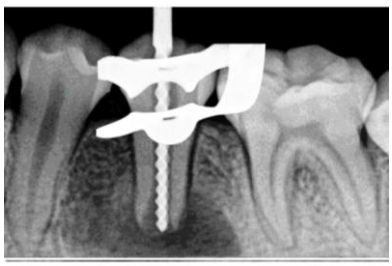

Figure 4: Estimation of Working length in 45 with the help of intraoral periapical radiograph (IOPA)

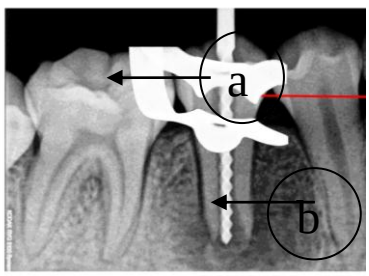

Figure 5: Estimation of Working length in 35 with the help of intraoral periapical radiograph(IOPA)

After three weeks, the teeth were prepared for revascularization procedure. Local anesthesia of 2% without adrenaline was administered bilaterally, and rubber dam was applied. The canals were irrigated with 20 ml of 3% sodium Hypchloride and 20 ml of normal saline. The canal systems were dried with absorbent paper points. A sterile 25 gauge needle was taken, and a rubber stopper was placed at 2mm beyond the working length. To induce intentional bleeding inside the canal from periapical tissues, the needle was pushed with sharp stroke into the periapical tissue. When frank bleeding was evident at the cervical portion of the root canal system a tight dry cotton pellet was kept in the chamber and held there for 7 to 10 minutes to allow formation of clots in the apical 2/3 rd of the canal. After 10 minutes, the cotton pellet was removed, and the coronal third of the root canal system was sealed with white MTA (Proroot,

Dentsply/Tulsa,Dental,Tulsa,OK,USA). Squeezed dry cotton pellet was kept in the chamber and access cavity was sealed with temporary restorative material and kept for 48 hours. The final restorain was done with Glass ionomer Cement (Ketac Molar Easymix #M ESPE) and Light cure composite resin (Z 350,3M, ESPE) (Fig 10). Finally, a base line radiograph was taken and patient was recalled at an interval of 6 months for the clinical and radiographical evaluation.

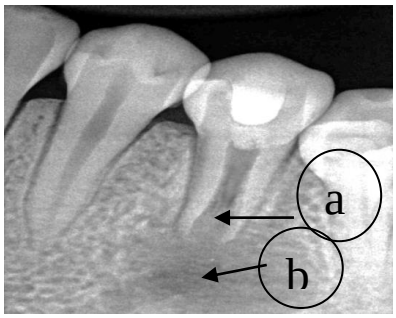

Figure 6: 6-month post-operative view of 35 indicating little radio-opacity in relation to root apex reporting hard tissue generation(a) and partial resolution of the periapical lesion in relation to the tooth (b).

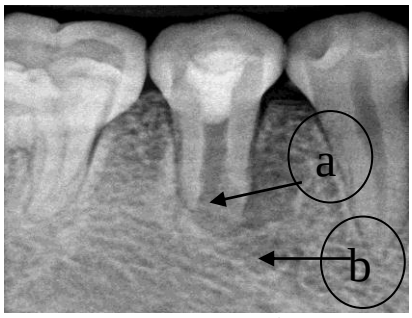

Figure 7: 6 month post-operative view of 45 indicating little radio-opacity in relation to root apex indicating hard tissue generation(a) and partial resolution of periapical lesion in relation to the tooth (b).

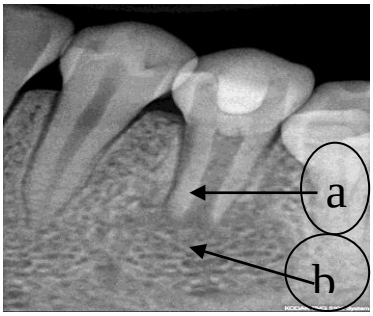

Figure 8: 2 years post operative view of 45 indicating thickening of the lateral dentinal wall (a) and almost complete resolution of the periapical lesion in relation to the tooth (b).

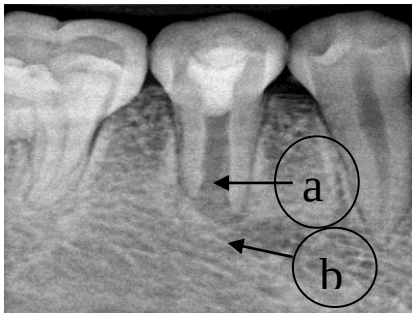

Figure 9: 2 years postoperative view of 45 indicating thickening of lateral dentinal wall (a) and almost complete resolution of periapical lesion in relation to the tooth (b).

The follow up on the present case was done between 6 months to two years. After six months, (Figure 6, Figure 7) complete resolution of clinical signs and symptoms were evident. In the final radiographic evaluation appreciable healing of periapical lesions and thickening of lateral dentinal walls were evident bilaterally (Figure 8, Figure 9).

Discussion:

The presence of dens evaginatus in the tooth surface indicates a disturbance in the normal tooth developing procedure. As it mostly contains the pulpal extension, it should be differentiated from the cusp of Carabelli or any other accessory cusps that do not include any pulpal extension (Ash, 2004). The development of Dens evaginatus indicates abnormal proliferation of inner enamel epithelium of the enamel organ along with the ectomesenchymal cells of the dental papilla during bell stage of tooth development (Ngeow,1998). But the recent knowledge of molecular biology indicates a great role of different signaling molecules released from the primary and 2nd enamel knots for regulating the cuspal morphology (Kumar,2010). During the cuspal morphogenesis, there is crosstalk between epithelium and mesenchyme. The prime signaling molecule like FGF4, TGFβ, BMP4, etc. are released from the enamel knot and stimulates the undifferentiated ectomesenchymal cells to secrete some signaling molecules like MSX, BMP4, and others. By the influence of the ectomesenchymal signaling molecules, the cells of the inner enamel epithelium get transformed into preameloblast followed by ameloblast cells initiating the tooth morphogenesis from the cuspal tip. The activation of primary enamel knot also regulates the formation of seconadary enamel knots which ultimately starts secondary cusp formation (Hill, 1984). The growth of the secondary cusp is regulated by the mitogenic BMP4. After the secondary cuspal initiation, the BMP4 itself causes activation of p21, which in turn causes apoptosis of enamel knots controlling the activity of the knot (Thesleff, 2003). In case of the lack of control by the mesenchymal signaling procedure on epithelial enamel knot, it may lead to the formation of the dental anomalies like Dens evaginatus. Depending on the area of enamel knot activation the location of dens evaginatus may vary.

Depending on the location, Schulge and co workers had divided Dens evaginatus for posterior tooth into five types (Table 1) [17] and our case for discussion comes under the fifth category. The outcome of the fractured Dens evaginatus depends on its amount of pulpal content. According to the pulp content

Oehlers,(1967) had classified DE into 1) Wide pulp horn (34%) 2) Narrow pulp horn (22%) 3) Constricted pulp horn (14%), 4) Isolated pulp horn remnants (20%) and 5) No pulp horn (10%) . As 70% cases of Dens evaginatus contain pulpal extension, pulp necrosis is the most common complication for this entity, which was also evident in the present case.

Table 1. Schulze classification of Dens evaginatus depending on its location. [17]

Types	Description
1	A cone-like an enlargement from the lingual cusp
2	A tubercle on the inclined plane of the lingual cusp
3	A cone-like enlargement of the buccal cusp
4	A tubercle on the inclined plane of the buccal cusp
5	A tubercle arising from the occlusal surface obliterating the central groove

To decide the treatment plan for Dens evaginatus on the basis of the condition of the pulp and maturity of the root apex, Levitan and Van T. Himel has given six categories(Table 2) and the case in discussion comes under type VI category according to this classification.

Table 2: Classification of Dens evaginatus on the basis of pulp condition and maturity of the root apex proposed by Levitan and Van T. Hime (2006).

Types	Description
Type I	Normal pulp, mature apex
Type II	Normal pulp, immature apex
Type III	Inflamed pulp, mature apex
Type IV	Inflamed pulp, immature apex
Type V	Necrotic pulp, mature apex
Type VI	Necrotic pulp, immature apex

There are several challenges for the treatment of type VI type of Dens evaginatus (Shah ,2008). It is quite difficult to clean the blunderbuss apex. The thin lateral wall can fracture during obturation and lateral condensation. There is a need of fabrication of customized thick guttpercha cone and there is a chance of splitting of the tooth during condensation making the obturation procedure really difficult (Shah, 2008). For choosing the treatment option all this factors need to be taken into consideration.

Available treatment options for type VI Dens evaginatus are: 1) Surgery followed by retrograde sealing, 2) Apexification by Calcium hydroxide 3) Apexification by the placement of MTA to create apical plug followed by immediate gutta-percha obturation and finally 4) Revascularization, where root lengthening and regeneration of the periapical tissue occurs(Shah,2008). . Every process has their advantages and disadvantages.

Treatment by surgery was not chosen as it had the chance to cause psychological stress to the young patient associated with other surgical complications.

Apexification by Calcium Hydroxide was the treatment of choice for blunderbuss apex since 1962 but eventually it was found to have some limitations (Frank, 1996). It takes 6-24 months for an apical barrier to form (Shah, 2008). .The apical barrier by Calcium Hydroxide is found to be porous due to the presence of soft tissue inclusion and can be described as ‘‘Swiss cheese–like’’(Trope, 2010). It makes the tooth brittle and in the long term also causes fracture of the treated teeth (Andreasen,2002) . Long standing contact of calcium hydroxide to the periapical tissue also causes degeneration of the potentially vital tissues due to its cytotoxicity(Shah, 2008).

Considering all the drawbacks of calcium hydroxide, in modern dentistry the material of choice for apexification is MTA (Mineral trioxide aggregates). MTA is preferred over Calcium hydroxide due to its biocompatibility. It not only produces a minimal inflammatory reaction the soft tissue (Sumer,2006) but also causes the activation of cementoblasts and even helps in the regeneration of PDL (Torabinejad, 1995 & Schwartz,1999). The apical barrier formed by MTA provides an adequate sealing required for this region (Lawley, 2004 & Matt, 2004) and the best part, the obturation can be done with in 3hrs after its placement.

One drawback of this technique is the need for lateral condensation of Gutta percha which may further weaken the thin lateral walls of the type VI Dens evaginatus (Shah, 2008). Along with there is no root lengthening by this technique so it may also compromise the anchorage of the teeth.

In young patients like in the present case where there is still chances of root development having wide open apex, apexogeneseis by revascularization is the best treatment option.

Revascularization procedure is dependent on the regeneration of the mature stem cells from the dental elements like pulp, periapical tissue and periodontal ligament (Thomson, 2010, K. Reynolds, 2009& M. Torabinejad, 2011). The stem cells in the pulpal space allow the odontogenic tissue regeneration. This unique form of regeneration can be considered as maturogenesis as this procedure allows root lengthening, thickening of lateral dentinal wall, formation of pulpal tissue with neoangiogenesis i.e regeneration of the functional pulp-dentin complex (Archana, 2010).It is a combined form of tissue repair and regeneration that can even reestablish the vitality of a non vital tooth (Archana, 2010) .

In the present case, after 2 years follow up all the radiographical evidences of root lengthening and thickening of the lateral walls were evident (Figure 8, Figure 9) indicating a successful revascularizaton procedure. Clinically the tooth was completely asymptomatic and no mobility was noted.

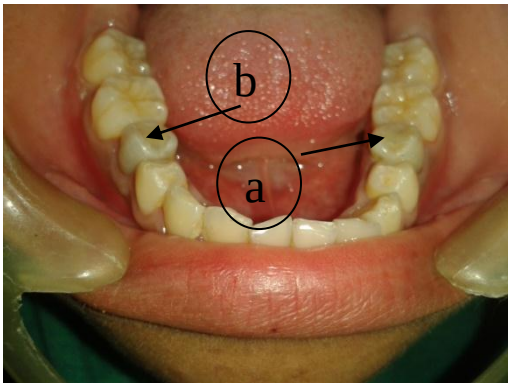

Figure 10: Clinical photograph of the patient with the permanent restoration in both 35(a) and 45 (b).

Conclusion:

By this study it can be concluded that revascularization can be successfully applied to a tooth with pulp necrosis to regenerate healthy pulpal tissue. It has significant treatment value for special cases like Dens evaginatus which most commonly

remains unnoticed leading to breakage of the tubercle and mostly having an unavoidable consequence of pulp necrosis.

ACKNOWLEDGMENTS

The authors report no conflicts of interests related to this study.

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