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A New Calcium-silicate Cement in the Endodontic Treatment of Immature Permanent Teeth: A Report of Two Cases.

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ABSTRACT

A new bioactive cement, Biodentine™ (Septodont, St. Maur-pass-Fosses, France) was recently launched on the dental market as a dentin substitute. Biodentine™ is perfectly biocompatible and capable of inducing the apposition of reactionary dentin by stimulating the odontoblast activity and reparative dentin by induction of the cell differentiation. During the setting reaction of the cement, ions of calcium hydroxide are released. Biodentine™ can be used in the pulpotomy of teeth with incomplete root formation. The present study reports two cases of pulpotomy treatment of immature permanent teeth: a 9-year-old patient with horizontal fracture on the enamel and dentin with pulp exposure on tooth #21; and an 8-year-old patient with deep carious lesion on tooth #36. The postoperative X-rays compared to the preoperative radiographs, as well as the clinical data of the two patients show that the apexogenesis continued successfully and the root formation was completed, without any adverse effects.

Keywords: calcium-silicate cement, apexogenesis, immature permanent teeth, pulpotomy

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INTRODUCTION

For many decades, calcium hydroxide has been the standard material for maintaining pulp vitality. Its' application in indirect and direct pulp capping, endodontic treatment of immature permanent teeth cannot be set aside [1]. Both clinically and histologically, previous research shows satisfactory results of its use in indirect and direct pulp capping, because of it is capability of stimulating the formation of tertiary dentin by the pulp [1]. Many studies show about 80% success of the calcium hydroxide therapy, while among the clinicians and scientists it serves as "gold standard" in these treatments [2]. However, it has some serious drawbacks, such as poor bonding to dentin, material resorption and mechanical instability. As a result, calcium hydroxide couldn't prevent microleakage in the long run. The porosities ("tunnel defects") of the newly formed hard tissue may act as a portal for access of microorganisms. In addition, the high pH (12.5) of the calcium hydroxide suspensions causes liquefaction necrosis at the surface of the pulp tissue [3].

A new bioactive cement, Biodentine™ (Septodont, St. Maur-pass-Fosses, France), was recently launched on the dental market as a dentin substitute. It shares both the indications and the mechanism of action with calcium hydroxide, but doesn't have its drawbacks. Biodentine™ consists of a powder in capsule and a liquid in a pipette. The powder mainly contains tricalcium and dicalcium silicate, the principal component of Portland cement, as well as calcium carbonate. Zirconium dioxide serves as a contrast medium. The liquid consists of calcium chloride in aqueous solution with an admixture of polycarboxylate. The consistency of Biodentine™ reminds of the phosphate cement. On the biological level, it is perfectly biocompatible [4] and capable of inducing the apposition of reactionary dentin by stimulating odontoblast activity [5] and reparative dentin, by induction the cell differentiation [6]. During the setting reaction of this cement ions of calcium hydroxide are released. The setting reaction is associated with an extremely alkaline environment and a pH-value of about 12.5, which stimulates the pulp tissue to form a reactive dentine [7]. Due to the alkalization of the environment, the high pH exerts a clear inhibitory effect on the microorganisms. In addition, the alkaline environment leads to disinfection of adjacent hard- and soft-tissue structures [7].

Biodentine™ can be used in variety of indications, such as pulp protection, temporary closure, deep caries management, cervical restorations, direct and indirect pulp capping and pulpotomy, management of perforations of root canals or the pulp floor, internal and external, apexification and retrograde root canal obturation [8].

Biodentine™ has high biocompatibility and bioactivity with the living cells and is both a dentin substitute base and a cement for maintaining pulp vitality and stimulating a hard tissue formation, i.e. formation of reactive or reparative (tertiary) dentin [8].

The purpose of the current study is to present two clinical cases that provide evidence of apexogenesis following Biodentine™ application in endodonic treatment of teeth with incomplete root closure.

Report of cases

Case report #1

A 9-year-old patient with traumatic injury on tooth #21 was admitted the Department of Paediatric and Preventive Dentistry, Faculty of Dental Medicine in Skopje. A horizontal fracture of the enamel and dentin with pulp exposure was diagnosed after the clinical examination followed by a retroalveolar X-ray. The X-ray also confirmed the expected incomplete root closure. Local anesthesia was applied and pulpotomy was performed according to the standard clinical technique. After cavity irrigation with NaOCl, the entire cavity was filled with Biodentine™. The regular check-ups showed absence of any discomfort, the vitality tests showed vital pulp, without sensitivity to percussion, while the next X-rays after 1 and 3 months (**Figure 1a., 1b.**) showed continuation of root formation and after 6 months (**Figure 1c.**) completely formed apex of the root without signs of any root resorption or widening of the periodontal ligament space.

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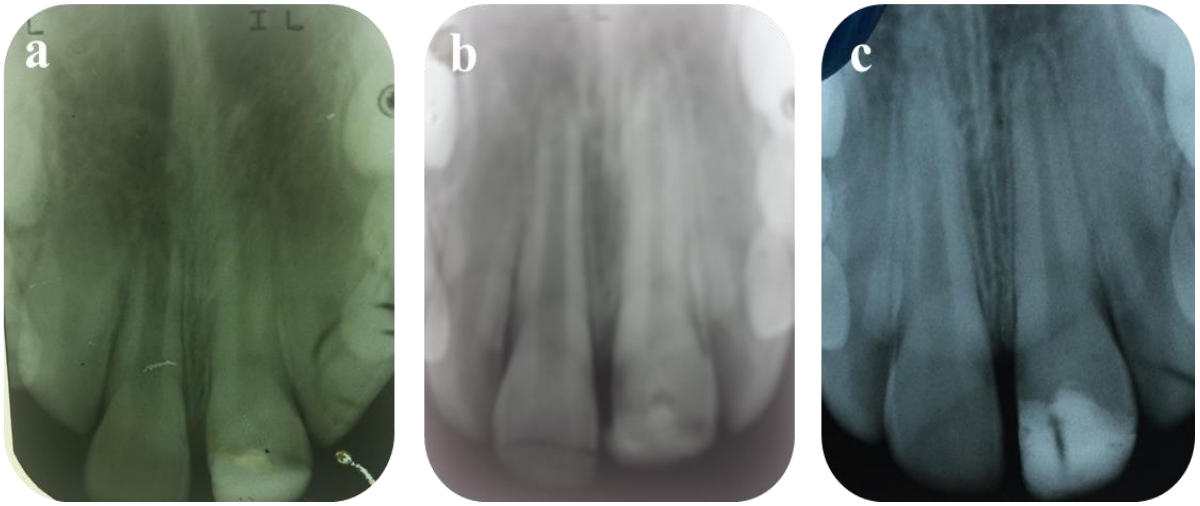
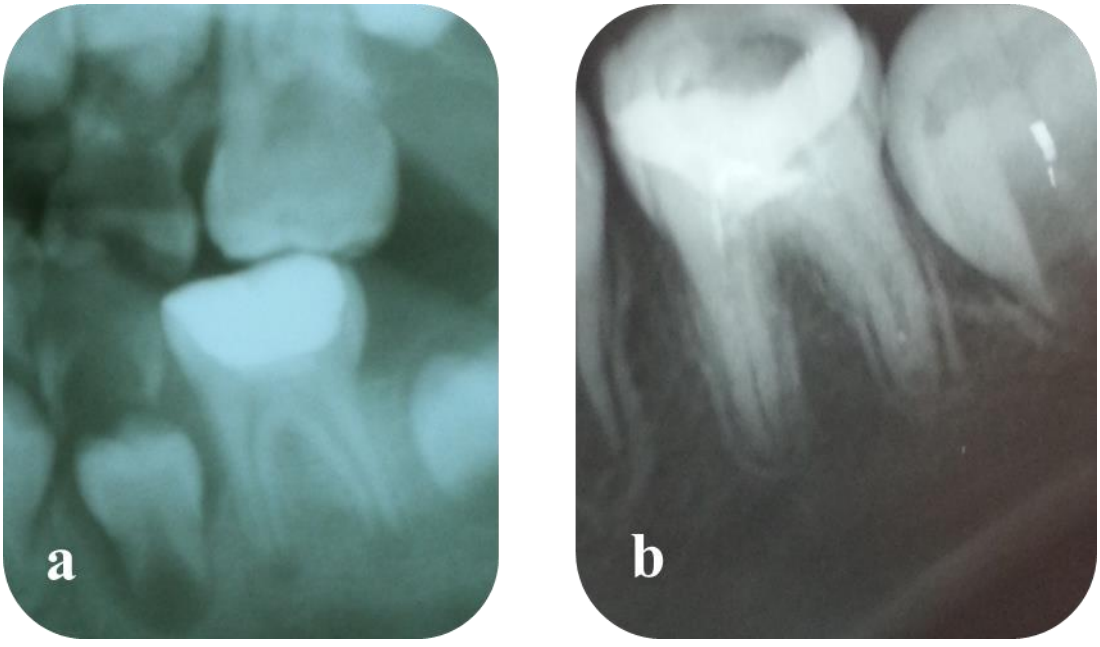
Figure 1. Retroalveolar X-radiography a. after 1 month, b. after 3 months and c. after 6 months following the treatment



Case report #2

An 8-year-old patient reported at the Department of Paediatric and Preventive Dentistry, Faculty of Dental Medicine, Skopje, due to durable, spontaneous pain, emphasized at night and located in the region of the tooth #36. The clinical examination revealed deep carious lesion on the occlusal surface on tooth #36. Retroaveolar X-radiography was performed, and the deep carious lesion with involvement of the pulp and an open apex, were visible. After application of a local anesthesia, atraumatic removal of caries was performed. During the preparation, profuse bleeding from the pulp occurred, symptomatic of an infection of the pulp chamber. The cavity was irrigated with NaOCl and haemosthasis was achieved. Pulpotomy was performed according to the standard clinical procedure. Biodentine™ was used to restore the entire cavity. The patient had not symptoms, no tenderness to percussion on the following check-ups and the vitality tests proves the normal pulp vitality. The control retroalveolar X-ray radiograph after 1 month (**Figure 2a.**) showed that the apexogenesis continued without disruptions, while after 6 months (Figure 2b.) the formation of the root was completed and the tooth showed no signs of root resorption or widening of the periodontal space or a periapical lesion.

Figure 2. Retroalveolar X-radiography a. after 1 month, and c. after 6 months following the treatment



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RESULTS AND DISCUSSION

The calcium-silicate cements are bioactive materials based on Portland cement [9], such as ProRoot MTA® [10, 11]. Their main drawback is the slow setting time (above 180 min) [12]. Biodentine™ is a new generation of the calcium-silicate cements with modified composition of the powder, by addition of setting accelerators and softeners, and a new pre-dosed capsule formulation for use in a mixing device [13, 14]. The cement has a faster setting time than other related materials (about 12 min) and, additionally, higher compressive strength [15].

Only a few studies have reported the effect of Biodentine™ in immature permanent teeth. Villat *et al.* performed partial pulpotomy using Biodentine™ in an immature second right mandibular premolar and demonstrated a fast tissue response both at the pulpal and root dentin level with formation of a radio-opaque bridge within 3-6 months. They suggested the use of tricalcium silicate cement should be considered as a conservative intervention in the treatment of symptomatic immature teeth [16].

The presented cases in this study showed that in immature permanent teeth, the pulpotomy carried out according to the standard clinical procedure, within the indications for this protocol, gave excellent results and the purpose, i.e. complete formation of the root, without any drawbacks, was achieved. The immature permanent pulpotomized teeth treated with the novel calcium-silicate cement Biodentine™ finished their apexogenesis and maturogenesis without any subjective signs reported by the patient, nor with visible clinical (reaction to percussion) or radiographic (widening of the periodontal space or root resorption) signs of progression of the pathologic process.

CONCLUSIONS

The results from the case reports prove the ability of the Biodentine™ to stimulate continuation of the root formation after pulpotomy in immature permanent teeth. Further clinical investigations should be performed in order to confirm the findings of the present study.

REFERENCES

[1] Duda S, Dammaschke T. Quintessenz 2008; 59: 1327-1334.
[2] Hörsted-Bindslev P, Vilkinis V, Sidlauskas A. Oral Surg Oral Med Oral Pathol 2003; 96: 591-600.
[3] Duda S, Dammaschke T. Endodontie 2009; 18: 21-31.
[4] Laurent P, Campus J, De Méo M, Déjou J, About I. Dent Mater 2008; 24: 1486-94.
[5] Goldberg M, Pradelle-Plasse N, Tran XV, Colon P, Laurent P, Aubut V, About I, Boukpessi T, Septier D. Working group of ORE-FDI-2009.
[6] Shayegan A, Petein M, Vanden Abbeele A. IADT 16th World Congress Dental Traumatology, 2010 June Verona, Italy.
[7] Firla MT. Septodont, Case studies collection, Focus on Biodentine. 2012; 18.
[8] Dammaschke T. Septodont, Case studies collection, Focus on Biodentine. 2012; 5.
[9] Zhao W, Wang J, Zhai W, Wang Z, Chang J. Biomaterials 2005; 26: 6113–6121.
[10] Torabinejad M, Hong CU, McDonald F, Pitt Ford TR. J Endod 1995; 21: 349–353.
[11] Camilleri J, Montesin FE, Brady K, Sweeney R, Curtis RV, Pitt Ford TR. Dent Mater 2005; 21: 297–303.
[12] Camilleri J, Montesin FE, Curtis RV, Pitt Ford TR. Dent Mater 2006; 22: 569–575.
[13] Wang X, Sun H, Chang J. Dent Mater 2008; 24: 74–82.
[14] Wongkornchaowalit N, Lertchirakarn V. J Endod 2011; 37: 387–389.
[15] Laurent P, Camps J, De Méo M, Déjou J, About I. Dent Mater 2008; 24: 1486–1494.
[16] Villat C, Grosgogeat B, Seux D, Farge P. Restor Dent Endod 2013; 38: 258-62.