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BIODENTINE™ AS A FURCAL PERFORATION REPAIR MATERIAL – A CASE SERIES

BIODENTIN™ – MATERIJAL ZA REPARACIJU FURKALNIH PERFORACIJA – PRIKAZ SERIJE SLUČAJEVA

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Summary

Introduction. So far, the most promising and most commonly used materials in endodontic treatment and retreatment were calcium silicate cements. However, due to the shortage of this material and treatment failures, a new bioactive material was introduced - Biodentine[tm]. It is a calcium silicate based technology, with excellent handling characteristics and biocompatibility. It can be used in various indications, including dentine substitution and endodontic therapy. **Case reports.** The clinical cases demonstrated excellent healing potential after the treatment with Biodentine[tm]. **Conclusion.** The bio-silicate technology is highly promising, mostly due to its chemical properties and easy clinical manipulation. The short setting time and high mechanical strength makes Biodentine[tm] a material easy to handle, highly biocompatible, with a wide range of indications.

Key words: Biocompatible Materials; Root Canal Filling Materials; Root Canal Preparation; Furcation Defects; Endodontics; Silicates; Calcium Phosphates; Treatment Outcome

Sažetak

Uvod. Do sada, najčešće korišćeni materijali u endodonciji, i ujedno materijali koji najviše i obećavaju u endodontskom tretmanu i retretmanu su bili kalcijum-silikatni cementi. Međutim, u skladu sa nedostacima ovog materijala i neuspesima tretmana, javio se novi materijal *Biodentine[tm]*. On je napravljen na kalcijum-silikatnoj tehnologiji sa odličnom biokompatibilnošću kao i karakteristikama u vezi sa aplikacijom materijala. Može da se koristi kod različitih indikacija, uključujući supstituciju dentina i endodontsku terapiju. **Prikaz slučajeva.** Klinički slučajevi pokazuju odličan potencijal lečenja nakon tretmana *Biodentinom[tm]*. **Zaključak.** Biosilikatna tehnologija veoma obećava najviše zbog hemijskih karakteristika i lake kliničke manipulacije. Kratko radno vreme i velika mehanička jačina čini *Biodentine[tm]* materijalom koji je jednostavan za korišćenje, visoke biokompatibilnosti i sa velikim opsegom indikacija.

Ključne reči: biokompatibilni materijali; materijali za punjenje zubnog kanala; preparacija zubnog kanala; defekti furkacije; endodoncija; silikati; kalcijum fosfati; ishod lečenja

Introduction

The calcium silicate cements, initially proposed as materials for retrograde obturation, have become the materials of choice for all kinds of dentine defects, including communication pathways between the root canal system and the periodontal ligament [1]. Their proven biocompatibility and ability to initiate calcium and phosphate incorporation at the interface with the periodontal tissue have a primary role in the reparation of the bone tissue [2–4]. The main disadvantage of this class of materials so far has been the slow application and complicated handling, which makes them technique-sensitive and hard to be used in everyday clinical practice [5].

Biodentine[tm] (Septodont, Saint-Maur-des-Fossés, France) is a relatively new material, which is the first all-in-one bioactive and biocompatible dentine replacement, based on the unique biosilicate technology. It can be used in a variety of indications, such as dentine substitution and in endodontic therapy. Biodentine[tm] employs a simplified clinical procedure. The healing process is an effect of the physical properties of this material, similar to the human dentine. The modified powder composition ensures the optimal physical characteristics of this material, and the pre-dosed capsule formulation highly simplifies the application procedure [6].

This paper aims to present several clinical cases treated for furcal perforation repaired with Biodentine[tm].

Case reports

Case 1. Reparation of the pulp chamber floor perforation following inappropriate endodontic treatment.

A 49-year-old male patient was referred to the Department of Restorative Dentistry and Endodontics due to a complication after a previous endodontic treatment. He complained of persistent pain on pressure in tooth 16, which started 2 weeks before. The tooth was

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Abbreviations
MTA – mineral trioxide aggregate

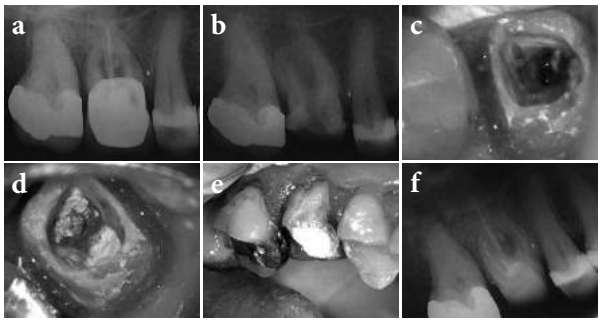

Figure 1. a. Preoperative radiographic view showing inadequate endodontic treatment and furcal perforation; **b.** Radiograph after the removal of the existing prosthetic crown and canal filling; **c.** Preoperative clinical view showing the furcation perforation; **d.** Obturation of root canals; **e.** Biodentine^{tm} used to manage the perforation and as a dentine substitute; **f.** After 6 months, complete healing of the furcal region is visible
Slika 1. **a.** *Preoperativni radiograf sa neadekvatnim endodontskim tretmanom i furkalnom perforacijom;* **b.** *Postoperativni radiograf nakon odstranjivanja protetske krune i kanalnog punjenja;* **c.** *Kavitet nakon endodontskog retretmana sa vidljivom furkalnom perforacijom;* **d**. *Obturacija kanala korena;* **e.** *Biodentin^{tm} je korišćen za prekrivanje perforacije i kao dentinska zamena;* **f.** *Nakon šest meseci, vidljivo ozdravljenje furkalne perforacije*

slightly tender on percussion and showed no mobility. The preoperative radiograph showed furcal perforation and erroneous access in the bucomesial aspect of the root canals **(Figure 1a)**. The patient had a history of root canal treatment, 3 weeks prior, which he had discontinued halfway. After the removal of the existing prosthetic crown, clinical examination revealed a large access cavity and a perforation of 1.5 mm on the floor of the chamber **(Figures 1b and 1c)**. The patient was informed about the situation and a decision was made to attempt repair the perforation followed by root canal retreatment. A signed consent was obtained from the patient and the treatment was initiated. The access cavity was refined and working lengths were determined using a No. 10 and 15 files. The canals were cleaned and shaped and sealed with calcium hydroxide for 2 weeks. After the remission of symptoms, the canals were irrigated and obturated by GuttaFlow **(Figure 1d)**. Then, the perforation and the entire cavity were restored with Biodentine^{tm}. Biodentine^{tm} was manipulated by mixing five drops of the liquid provided by the manufacturer into the capsule. The capsule was then placed on a mixing device, amalgamator for 30 seconds. The mix was carried to the site of perforation **(Figure 1e)**. Six months later, complete healing of the furcal region was visible **(Figure 1f)**.

Case 2. Endodontic retreatment, perforation repair of the pulp chamber floor following inappropriate endodontic treatment and dentine substitution.

A 32-year-old male patient presented to the Department of Conservative Dentistry and Endodontics with a complaint of pain to percussion in tooth 16. The preoperative radiograph showed inadequately sealed root canals, periapical lesions with iatrogenic lateral root perforation of tooth 16 **(Figure 2a)**. Iatrogenic lateral root perforation with incomplete obturation was diagnosed, and with the patient's consent an attempt was made to preserve the tooth by sealing the endo-perio communication. After removal of the existing restoration, the endodontic treatment was performed in two phases: after removal of the filling, the canals were instrumented using No 35 k file, calcium hydroxide was used as an intracanal medication and closure of the periodontal communication with glass ionomer cement for 2 weeks **(Figure 2b)**. After 2 weeks, the tooth was asymptomatic and the canals were dry. After the remission of symptoms, apical seal with Biodentine^{tm} and final root canal sealing was performed **(Figure 2c)**. Then, the perforation and the entire cavity were restored with Biodentine^{tm}. The follow up at two months showed no clinical signs, and the X-ray confirmed complete healing of the apical and perforation site and the patient was referred to a prosthodontist. Two years after treatment, the tooth was painless and fully functional **(Figure 2d),** as well as 7 years after treatment **(Figure 2e)**.

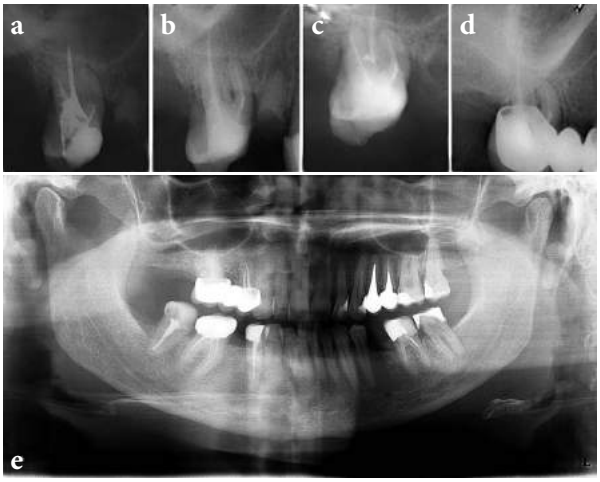

Figure 2. a. Inadequate endodontic treatment, furcal perforation; **b.** Calcium hydroxide canal filling, application of glass ionomer cement and distal closure of the periodontal communication; **c.** Definitive sealing of the root canals with guttapercha and sealer; the cavity was restored with Biodentine^{tm}; **d.** Appearance of the prosthetic appliance after 2 years; **e.** Appearance of the prosthetic appliance after 7 years
Slika 2. **a.** *Neadekvatan endodontski tretman, usled furkalne perforacije;* **b.** *Punjenje kanala kalcijum-hidroksidom, aplikacija glas-jonomer cementa i distalno zatvaranje periodontalne komunikacije;* **c.** *Definitivno zatvaranje kanala korena gutaperkom i pastom, kavitet je restauriran Biodentinom^{tm};* **d.** *Izgled zubne nadoknade nakon 2 godine;* **e.** *Izgled zubne nadoknade nakon 7 godina*

Discussion

Iatrogenic pulp floor perforation can occur if the operator becomes disorientated when trying to locate canal orifices. Perforation repair can be technically challenging, and offering referral if treatment is beyond the expertise of the operator [7]. Perforation is defined as

the pathological or iatrogenic communication between the root canal space and the periodontal tissue. Furcal perforation is usually an undesired complication that can occur during preparation of endodontic access cavities or exploring canal orifice of multirooted teeth [8]. These undesirable situations such as excess removal of tooth structure or perforation occur during attempts to locate canals or as a direct result of failing to achieve straight line access to the canals. In the process of searching for canal orifices, perforations of the crown can occur either peripherally through the sides of the crown, or through the floor of the chamber into the furcation [9]. The interval between perforation and repair is one of the critical factors for success. Immediate sealing of perforations enhances the repair process, by reducing the possibility of bacterial contamination of the defect. In the current cases, the perforation in the furcation and sufficient coronal structure was present, so we decided to repair the perforation with a biocompatible material, Biodentine^{tm}. Biodentine^{tm} is a calcium silicate-based bioactive material. It is a powder liquid system, powder composed of Tri-calcium silicate, Dicalcium silicate, Calcium carbonate and oxide, Iron oxide, Zirconium oxide. Liquid consists of Calcium chloride, Hydro soluble polymer [10, 11]. Biodentine^{tm} contains tricalcium silicate with additives such as powder and a liquid, containing Calcium chloride to speed up setting. Calcium silicate materials have excellent biocompatibility and are able to induce calcium-phosphate precipitation at the periodontal ligament interface allowing bony healing (Tay, et al., 2007, Torabinejad and Parirokh, 2010). With a reduced setting time compared to mineral trioxide aggregate (MTA), Biodentine^{tm} is perhaps more user-friendly for perforation repair [12]. It is easy to handle owing to its ease of manipulation and a short setting time - approximately 12 minutes, has high alkaline pH and is a biocompatible material that makes it a favorable material for perforation repair [13, 14]. In a study by Guneser et al., Biodentine^{tm} showed considerable performance as a perforation repair material even after being exposed to various endodontic irrigants as compared to MTA [15]. However, very few papers are available regarding the use of Biodentine^{tm} as a perforation repair material. The use of Biodentine^{tm} seems promising in the present cases. As the setting is faster, there is a lower risk of bacterial contamination than with MTA. Adding to its ability to be used as dentine substitute, Biodentine^{tm} could safely be used for each indication where dentine is damaged [16]. Therefore, it is an advantage to the clinician and the patient.

Conclusion

The use of Biodentine^{tm} for repair of furcal perforations is associated with a good short-term clinical outcome. The new bio-silicate technology, represented by Biodentine^{tm} is highly promising, mostly due to its chemical properties and easy clinical manipulation. The short setting time and high mechanical strength makes Biodentine^{tm} a material easy to handle, highly biocompatible and with wide range of indications (such as endodontic procedures and as a dentin substitute in restorations).

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