SCIENTIFIC ARCHIVES OF DENTAL SCIENCES (ISSN: 2642-1623)

Volume 2 Issue 11 November 2019

Case Report

X-ray Analysis of Apical Closure by Direct Pulp Coating Using Biodentine in Definitive Piece; Case Report

Andrea Ponce Bueno, Mónica Banda cifuentes, Denny Domínguez Gaibor, Marìa Josè Jarrìn* and Alexander Cruz Gallegos

Universidad Tecnológica del Ecuador, Quito, Ecuador

***Corresponding Author:** Marìa Josè Jarrìn, Universidad Tecnológica del Ecuador, Quito, Ecuador.

Received: September 13, 2019; **Published:** October 17, 2019

Abstract

New techniques and biomaterials to solve pulp problems in both types of teeth continue to be developed today. Biodentine® is a calcium silicate cement, which is used as a bioactive substitute for dentin, which by applying it favors the healing of pulp tissue, increasing the migration, proliferation and adhesion of pulp cells, of this way is rated as an ideal material. The preservation of the vitality of the pulp will allow the constant progress of apical formation and closure. The report of a case using Biodentine®, is presented in a definitive molar. Male patient 8 years old. Dental organ 3.6 presents a nolla 8 stage. The biomaterial was used, as a direct pulp coating to subsequently analyze root formation, thickening of the root walls and by the last closure applied, using periapical x-rays. Biodentine® could be considered as an effective and promising biomaterial in direct pulp coating treatment in definitive teething, however long-term clinical studies are necessary for that drug to become, into the first choice in such treatments. In the follow-up to the 1st, 2nd, 3rd and 6th months, both clinical and radiographic dental organ 3.6 is asymptomatic, the roots continued to develop and there was no sign of periapical injury.

Keywords: Biodentine; Direct Pulp Coating; Definitive Teething

Introduction

Dental trauma disease or cavities in a tooth with immature apex, requires a treatment that ensures a closure of the apex and widening of the walls to reduce the risk of bill in it, in addition, of the regeneration of pulp. The current dentistry has managed to develop new materials among them is the Biodentine, it is a new restorative cement based on calcium silicate with mechanical properties similar to dentin [1]. The use of Biodentine helps to maintain the vital tissue of the pulp, generates the development, propagation and differentiation of stem cells for regeneration, as a result, stimulates the production of reconstructive dentin. Can be used in crowns and roots; applications on the crown include pulp protection, temporary closure, deep cavity management, cervical filling, direct and indirect pulp protection, root perforation and pulpotomy [2].

Injuries to immature teeth can occur from cavities or trauma, they should be treated immediately, before they produce pathological complications that make it difficult to repair [3]. Treatment will depend on the degree of root development and the degree of pulp agency. Choosing the right material is essential when an injury to a permanent tooth with immature apex occurs [4].

Dentin formation and root growth stop when root growth does not complete due to the death of pulp before this process ends, it is when a root with broad and open apex is presented, in some cases also presents by Extensive reabsorption, which provides a challenge as it hinders conventional endodontic procedures by narrowing the root walls, these are prone to fracture [4]. The dental pulp provides a matrix for the fusion of cells and generates a basis that facilitates the exchange of information between these [5]. In addition to immune cells, the pulp contains odontoblasts, which are specialized cells capable of making dentin [6]. Injuries to an immature definitive tooth can induce cessation of dentin formation and complete root development. The endodontic procedure tends to get complicated in premature teeth with a reserved prognosis [5].

In the search for new dental materials, with regenerating and dentin-like properties to replace damaged tissue, by developing binding with a suitable component to achieve marginal sealing and appropriate clinical use [5]. Calcium silicate-based cements are found. As bioceramics such as Biodentine that maintains the pulp vitality and induces root formation, this process causes a structural transformation of the dentin, thus acquiring a superior resistance [6].

Stages of nolla

Classification of the tooth development cycle in 10 stadiums ranging from the beginning of the formation of the crypt (stage 1) to apical closure (stadium 10). Nolla stadiums but displayed on panoramic x-rays [7].

The goal of apexogenesis is the preservation of vital pulp tissue, so continuous root development with apical closure may occur. In clinical practice it is not uncommon to find incompletely developed teeth that require some form of endodontic intervention due to extensive cavities or traumatic injury. When such a clinical situation occurs, the pulp status and degree of dental development made to develop an appropriate treatment plan should be evaluated. Depending on the extent of the inflammation, pulp [8]. Pulp coatings, surface pulpotomy or conventional pulpotomy can be made. It has been shown that when a direct coating procedure of the pulp is performed on a tooth with an exposed and inflamed pulp, the likelihood of pulp repair. The loss of vitality in open celery tooth should be prevented as the young tooth without pulp often has thin and fragile walls, making it difficult to properly clean and obtain the necessary apical seal [9].

Protocol to be followed in case of:

- Probability of pulp exposure indirect pulp coating should be performed
- Small pulp exposure should be made direct pulp coating.

Proper exposure expands clinical and radiographic examination will depend treatment. Partial pulpotomy or total pulpotomy. Both treatments, if successful, maintain the pulp vitality and integrity of the Hertwig epithelial sheath, enabling normal histological and anatomical root development [9].

Pulp coating: Involves all maneuvers, substances and materials that are used during cavitation preparation and restoration and that tend to constantly protect the vitality of the dentinopulpar organ [9].

Direct pulp coating: It is the protection of a wound or iatrogenic exposure by pastes or special substances, in order to heal and preserve the pulp vitality [9].

Biodentine

Biodentine is a new commercial inorganic restorative cement based on tricalcium silicate (Ca_3SiO_5) and is advertised as a "bioactive dentin substitute". which was marketed in 2009 by (Gilles and Olivier in partnership with Septodont's, France) [10]. It is claimed that this material has better physical and biological properties compared to other tricalcium silicate cements, such as mineral trioxide aggregate (MTA) and bioaggregate [11].

It has bioceramic properties and bioactivity properties that, in direct contact with the pulp tissue, induces the development of reparative dentin and achieves the maintenance of tissue vitality and function. [11]Bioceramic cements with biocompatible components similar to hydroxyapatite are currently available. Biodentine is based on Active Biosilicate Technology active biosilicates™ septodont and is the first dentin substitute to offer excellent sealing and bioactivity properties to completely supplant dentin, in the crown as in the root in which the dentin is damaged [11].

Properties

- **Working time:** greater than 6 minutes.
- **Setting time:** 10 to 12 minutes.

Composition

Dust	
Silicate Trichloro (Ca_3Si)	Structural component of the material
Di-Calcium Silicate (Ca_2Si)	Secondary material structure
Carbonate and Calcium Oxide	Filling
Zirconium Oxide	Radio opacification
Liquid	
Calcium chloride	Accelerator
Water-Soluble Polymer	Water reducing agent

Table 1: *BD composition.*

Source and elaboration: Composition of BD (Bachoo Seymour., et al. 2013).

Biodentine adhesion

There are two hypotheses or two processes that can be combined, possibly contributing to the adhesion of Biodentine cement to the dental surface: physical process of crystal growth within the dentin tubules that leads to an anchor and micromechanical that ensures long-lasting sealing. Through ion exchanges between cement and dental tissues [12].

Mechanical resistance

Calcium silicate-based cements have low mechanical properties, the presence of components such as aluminates, which ultimately determines the fragility of the product. A water-reducing agent (water-soluble polymer) was incorporated into the liquid, whose mission is to maintain the balance between the water content. These properties make Biodentine an excellent substitute for dentin and a splendid material to be used in semi-permanent particularity restorations, since its mechanical strength according to research is 131.5 Mpa on the first day and goes increase to 300 Mpa in a month [13].

Presentation of the Case

To the undergraduate clinic of dentistry of the Equinoccial Technological University in Quito, Ecuador, Ian for evaluation an 8-year-old boy, accompanied by his mother. The reason for consultation was; "It hurts when I chew and drink cold water." During clinical interrogation, the mother reported that the girl had no relevant family or personal medical history.

The extraoral examination showed facial tissues within normal parameters. The intraoral examination showed extensive occlusal cavities in the first lower left molar (3.6) (Figure 1).

Figure 1: *ICDAS cavity injury 6.*

In the X-ray examination, a radiolucent shadow was observed at the coronal level compatible with cavities, no radiolucent shadow at apical level compatible with periapical lesion. It was also determined that he was in the state of Nolla 8 (Figure 2).

Figure 2: *Initial radiography of the dental organ (3.6) where the care injury is evident.*

Endodontic tests of tooth 3.6 were diagnosed, which presented: Spontaneous pain, localized and intermittent. Increased percussion. Sensitivity tests were met with a rapid and intense response to cold stimulus while heat was a negative response. The same when the care injury was removed, the pulp exposure occurred. It was decided to place Biodentine to maintain the vital root pulp and as an inducer of apexogenesis due to being an ideal material for the regeneration of the dentino-pulp complex.

The patient was explained about the procedure to be performed and signed the informed consent.

During the procedure, the behavior of our patient was correctly handled, topical anesthetic was first applied for one minute, then anesthetized the lower dentary nerve with direct trunking technique and reinforced with local anesthesia Infiltrative in the molar area.

Absolute isolation was performed

The restoration and decayed fabric, with high-speed piece and medium round diamond cutter, was removed, a spoon was used to remove the affected dentin and could observe the pulp exposure. It washed abound with physiological solution and dried with sterile stumps (Figure 3).

Biodentine biomaterial was prepared: The capsule where the powder comes from was added and a portion was placed in the tile and 3 drops of liquid was added, mixed with a metal spatula for 30 seconds, then using a Dycal placed it directly in the exposure Pulp. It was waited 5 minutes for a forge to place a base glass ionomer base, then a direct restoration of photocurable resin and a postoperative control X-ray was placed (Figure 4).

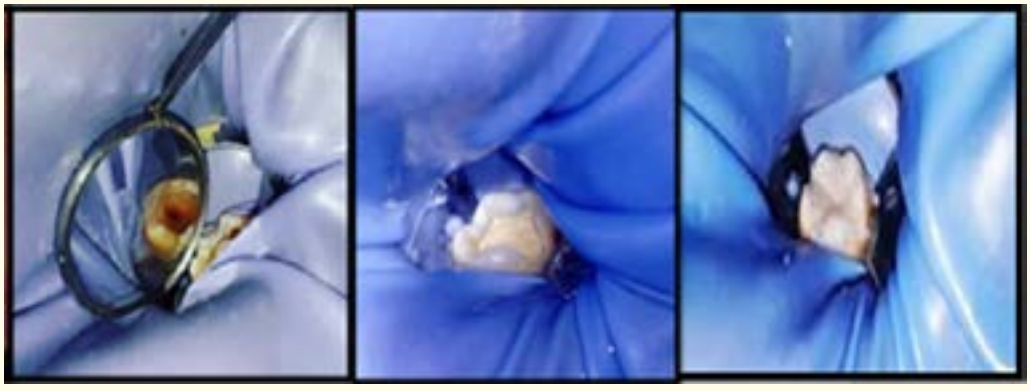

Figure 3: *Withdrawal of cavities, placement of the Biodentine base and to finish with a direct restoration of photocurable resin.*

Figure 4: *From left to right 1 Intraoral photography; 2 pulp exposure photography; 3 photograph biodentine placement; 4 final restoration photograph with resin.*

The radiographic clinical control was performed at the 1st, 2nd, 3rd and 6th month, in which symptom signs such as percussion and palpation, presence of fistula and inflammation were evaluated. In addition, root formation was analyzed, the thickening of the root walls and by the last closure apply. It finds asymptomatic, the roots continued to develop and there was no sign of periapical injury (Figure 5).

Figure 5: *From left to right. 1 Initial x-ray; 2X 1st month control; 3 Control x-ray 2nd month; 4 Part Tomography 3.6 Control 3rd month; 5 X-ray control 6th month.*

Discussion

The goal of pulp coating therapy is to maintain all the functions of the pulp complex, especially the regenerative potential [14]. In the market there are various materials, this time it is decided to place a material with favorable physical, chemical and mechanical characteristics in addition to the clinical advantages such as Biodentine [15].

Biodentine setting time is faster than MTA, which improves its handling and resistance properties, reducing the risk of partial material loss and interface alteration during the completion phase of the procedure. Therefore, Biodentine has a great improvement compared to MTA in terms of time [15].

Studies of Biodentine vs IRoot BP, Ceramicrete and ProRoot MTA using micro-CT characterization result in little significant differences in porosity between the new calcium silicate containing repair cements and MTA. Due to the low water content at the mixing stage, Biodentine exhibits a lower porosity than MTA [16].

Grech L., *et al.* Showed that Biodentines resistance to compression increases 100 MPa in the first hour and 200 MPa at 24 hours and continues to improve over time for several days until reaching 300 MPa after a month had the highest compress resistance than had it is comparable to the natural dentin compression resistance i.e. 297 MPa compared to other proven low-value water/cement materials used in BD. Biodentine is stable enough to be used as a temporary filler even in the chewing loading region [1].

The mean radiopacity for MTA has been found to be 7.17 mm thick in the equivalent of aluminum and Biodentine reported a radiopacity of 3.5 mm aluminum. Grech L., *et al.* they evaluated the radiopacity of Biodentine cement, Bioaggreagte and tricalcium silicate and found that all materials had a radiopacity value greater than 3 mm of aluminum. However, they observed a lower radiopacity of biodentin compared to MTA [10].

The use of water-soluble polymer in the composition of Biodentine reduces the amount of water that has a positive influence on the density of Biodentine. The lower porosity of Biodentine leads to greater mechanical strength. Biodentine exhibits a lower porosity than Dycal and MTA [17].

Another study shows that the antibacterial and antifungal properties of MTA and Biodentine. Being Biodentine the best due to the high pH. Calcium hydroxide ions released from cement during the setting phase increase pH to 12 (medium heating), which inhibits the growth of microorganisms and can disinfect dentin [11,12].

Hiremath GS and others, evaluated the antimicrobial efficacy of Biodentine, MTA and MTA Plus and found that MTA and Biodentine showed a significant antimicrobial effect against *E. faecalis* while MTA Plus proved to be a good antifungal agent against Candida Albicans. Another study reported the antibacterial and antifungal characteristics of Biodentine, MTA and Glass Ionomer cement (GIC) and concluded that Biodentine shows a higher antimicrobial action than MTA and GIC [18].

Dentin incorporates the elements released from the bioactive materials (Ca and Si), and thus causes a structural change of the dentin, thus acquiring greater resistance [19].

Laurent P., *et al.* they evaluated the ability of Biodentine, MTA, calcium hydroxide and Xeno III to induce reconstructive dentin synthesis and secretions of beta 1 transforming growth factor (TGF-b1). They showed that both Biodentine and MTA participate in early dental differentiation and in the onset of mineralization and therefore form a restorative synthesis of dentin and then two other materials. The secretion of TGF-b1 increased significantly with Biodentine, in relation to MTA and calcium hydroxide and Xeno III [20].

Luo Z., *et al*. they studied the effect of Biodentine on human dental pulp stem cells (hDPSCs) observed that biodentine significantly increased the proliferation, migration and adhesion of stem cells when placed directly in contact with the pulp, which further reflects the bioactivity and biocompatibility properties of the material. Biodentine can promote mineralization, generating a reactionary dentin and a dense dentin bridge when in contact with the pulp [20].

Hassan., *et al*. they reported the superiority of Biodentine compared to ProRoot MTA in terms of handling and setting speed, as well as lower microfiltration, with Biodentine being the first choice material in drilling repair and other pulp problems, given its biocompatibility and strong mechanical properties [10].

Conclusion

The use of bioceramics such as biodentine contributes to treatments for direct and indirect pulp coating on deciduous and permanent teeth, seals exposure and maintains pulp vitality. Biodentine maintains pulp vitality, helps osteodentin to the formation of restorative dentin and induce at the apex closure. Final restoration on biodentine is needed to form a total seal that

prevents bacterial microfiltration and affects apexogenesis. It can be removed and remodeled to restore. The surface of Biodentine can be adhered as dentin with several adhesives previously of terminal resin placement. A positive change at the level of wall widening at the root level was observed in the radiographic record and has no periapical pathologies. Functional and aesthetic results in the clinical case demonstrate the promising applicability of the use of Biodentine in apexogenesis, besides that it does not need any surface conditioning treatment.

Bibliography

1. K Laslami, S Dhoum, M Karami, M Jabri. Direct Pulp Capping with Bioactive Material: Biodentine. EC Dental Science. 2017;13(2):75-83.
2. Emphasis S, Valerio AL. Biodentine: a new proposal in pulp therapy. Univ Odontol. 2015;34(73):69-76.
3. bu-H Muhamad, A Abdulgani, M Abdulgani, J Ayah. Management of Open Apex in Permanent Teeth with Biodentine. IOSR-JDMS. 2017;16(2):135-140.
4. Canalda Sahli C, Brau Aguadé E. Endodontics. Clinical techniques and scientific bases. 3rd edition. Barcelona: Masson; 2014.
5. Cohen S, Hargreaves KM. Flesh pathways. 11th edition. Madrid: Elsevier Mosby; 2016.
6. Gomez by Ferraris ME, Campos Muñoz A. Histologia, embryology and Ingenieria Tisular Bucodental. 4th Edition. Pan American Medical Editorial; 2019.
7. McDonald Avery. Dentistry for the child and adolescent. 9th Edition Argentina: Almolca; 2014.
8. Silva D, Herz F, Rodríguez F, González L. Evaluation of Biodentine's apical microfiltration™ as apical sealing material by transporting computerized fluids. ADM Magazine. 2016;72(2):65-71.
9. Zhou H, Shen Y, Wang Z, Li L, Zheng Y, Hakkinen l, Haapasalo M. In vitro cytotoxicity evaluation of a novel root repair material. J Endod. 2013;39(4):478-483.
10. Nowicka A, M Lipski, M Parafiniuk, K Sporniak-Tutak, D Lichota, A Kosierkiewicz, W Kaczmarek, J Buczkowska-Radlinska. Response of human dental pulp capped with biodentine and mineral trioxide aggregate. J Endod. 2013;39(6):743-747.
11. Takuma-Shinkawa A, Alamo-Palomino J. Biodentine ®: A new option for the treatment of fur drilling. KIRU. 2018;15(2):81-84.
12. Allwyn S, Sharath A, Seby T. Evaluation of sealing ability of Biodentine and mineral trioxide aggregate in primary molars using scanning electron microscope: A randomized controlled in vitro trial. Contemp Clin Dent. 2016;7(3):322-325.
13. Heredia A, Bhagwat S, Mandke L. Biodentine as material of choice for furcal perforation repair – A case report. Ann Prosthodont Restor Dent. 2016;2(2):54-57.
14. M Forghani, I Parisay, A Maghsoudlou. Apexogenesis and revascularization treatment procedures for two traumatized immature permanent maxillary incisors: a case report. Restor Dent Endod. 2013;38(3):178-181.
15. J Cedillo, J Cedillo. Current clinical protocol for deep restorations. Contemporary clinical protocol for deep restorations. Rev ADM. 2013;70(5):263-275.
16. Biodentine. Bioactive substitute for dentin. Septodont.
17. Grech L, Mallia B, Camilleri J. Investigation of the physical properties of tricalcium silicate cement based root end filling materials. Dent Mater. 2013;29(2):e20-e28.
18. Cedrés C, Giani A, Laborde J. A New Biocompatible Alternative: BIODENTINE. Dental proceedings. 2014;9(1):11-16.
19. Koubi G, Colon P, Franquin JC, Gilles R, Faure M, Lambert G. Clinical evaluation of the performance and safety of a new dentin substitute, Biodentine, in the restoration of posterior teeth-a prospective study. Clin Oral Invest. 2013;17(1):243-249.
20. Balachandran J, Gurucharan. Comparison of sealing ability of bioactive bone cement, mineral trioxide aggregate and Super EBA as furcation repair materials: A dye extraction study. J Conserv Dent. 2013;16(3):247-251.

Volume 2 Issue 11 November 2019