International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319 –6505, Impact Factor: SJIF: 5.438
Available Online at www.journalijcar.org
Volume 6; Issue 1; January 2017; Page No. 1708-1711

Research Article

COMPARATIVE EVALUATION OF EFFECT OF FINAL RINSE AGENTS ON THE BOND STRENGTH OF BIODENTINE

Vandana Gade*., Aparajita Gangrade and Jaykumar Gade

Department of Conservative Dentistry and Endodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur

A R T I C L E I N F O

Article History:

Received 8th October, 2016
Received in revised form 17thNovember, 2016
Accepted 14th December, 2016
Published online 28th January, 2017

Key words:

Biodentine, Q Mix, Glyde File Prep, EDTA, Citric Acid, Pushout, Perforation.

A B S T R A C T

Introduction: Perforations can occur during any endodontic process. Its management is decisive in the tooth’s prognosis. Perforation repair is done prior to endodontic therapy, leading to interaction of irrigants with the repair material. Biodentine is a widely used repair material.

Aim: Evaluate the push out bond strength of Biodentine after treatment with final rinse agents, Q MiX, 17% EDTA, Glyde File Prep and 10% Citric acid.

Materials and Methods: In this study 60 dentine slices of 2-mm thickness were prepared with lumen 1.3mm. Biodentine was placed in the samples and incubated for 24 hours. Subdivision of groups into 6 was done; distilled water (control), Saline, 17% EDTA, 10% Citric acid, Q Mix and Glyde File Prep. Immersion was done for 30 minutes. The samples were sent for push out test.

Results: Results showed that Control showed the highest bond strength followed by Q Mix, saline, citric acid, EDTA and Glyde file prep. Q Mix showed the least negative influence on the pushout bond strength of Biodentine as compared to other final rinse agents.

Conclusion: Q Mix is the irrigants of choice in case of perforation repair with Biodentine as final rinse agent.

INTRODUCTION

The solitary purpose of Endodontic therapy is to clean, shape and obturate the root canal space three dimensionally and furthermore prevent reinfection (Gupta 2015)Cleaning and shaping is considered to be pivotal in determining the success or failure of Endodontic Therapy. (Gupta 2015, Cohen 2011) Perforations are complication that can occur due to caries, resorption or iatrogenically during endodontic treatment or post space preparation of teeth (Guneser 2013, Aggarwal 2013). Perforations are artificial communication between root canal system and the supporting tissues of teeth or the oral Cavity (Gutmann 1991).

The prognosis of perforation repair depends on the location of the perforation, size of the perforation, time of occurrence of the perforation and the material used for the repair. Successful management of furcal perforations poses a challenge for a clinician (Aggarwal 2013). Ideally, perforations should be immediatelysealed with a biocompatible material to halt the passage of fluids from within to outside the tooth and vice versa, so as to achieve a favourable prognosis (Nagas 2014, Fuss 1996).

Nonsurgical endodontic treatment is performed with various endodontic irrigants and final rinse with chelating agents namely 17% EDTA and Glyde File Prep (Nagas 2014, Elnaghy 2014).

Biodentine (Septodont, Saint Maur des Fossés, France) is a high-purity calcium silicate based dental material composed of tricalcium silicate, calcium carbonate, zirconium oxide and a water-based liquid containing calcium chloride as the setting accelerator and water-reducing agent. (Guneser 2013)

Studies done by M.B. Guneser (2013) and A Elnaghy (2014) suggest that Biodentine had significantly higher bond strength as compared to MTA when exposed to regularlyused irrigating solutions such as NaOCl, EDTA, CHX and Saline.

However no study has been performed yet to establish a definite relation between the effects of various final rinse agents on the bond strength of Biodentine.

This study aims to evaluate the effect of 17% EDTA, Glyde File Prep, 10% Citric Acid and recently introduced Q MiX ™ 2 in 1 solution on the pushout bond strength of Biodentine.

MATERIALS AND METHODS

60 Single rooted teeth were selected and stored in 10% buffered formalin (Fig 1). All teeth were decoronated and mid root dentine were sectioned horizontally into slices of 2 mm thickness. In each sample, canal space was prepared by Gates Glidden bur # 1 through # 5 to a standardize cavity of 1.3 mm

diameter.Dentine slices were thoroughly irrigated with 3% NaOCl for 5 minutes and washed with distilled water. Biodentine was placed within the lumen of all dentine slices.

These samples were wrapped in wet gauze and placed in incubator and allowed to set at 37°C and 100% humidity for 24 hours. After incubation, samples were randomly divided into 6 subgroups on the basis of final irrigant used. (Table 1)

After immersion for 30 minutes in the respective final rinse agents, all samples were removed from solution, rinsed with distilled water, and allowed to set for 48 hours at 37°C and 100% humidity in an incubator.

Samples were embedded in self-cured acrylic and were sent for push out testing. (Fig2) Push out bond strength values were measured by using universal testing machine. The samples will be placed on a metal slab with a central hole to allow for free movement of the plunger of 1mm diameter, at a crosshead speed of 1 mm/minute (Fig 3). Maximum force applied to materials at the time of dislodgement was recorded in newton (N), and converter into megapascals by the formula, N/2πrh.

RESULTS

Table 2 provides the descriptive statistics for push out bond strength of Biodentine in presence of different decalcifying agents. (Table 2, Figure 4)

One-way analysis of variance (ANOVA) was used to determine the statistical significance of difference in the mean push out strengths of Biodentine across decalcifying agents (Table 3). Paired analysis of push out strength between decalcifying agents was performed using Tukey's post-hoc test(Table 4). Table 4 provides the pair wise comparisons of push out bond strength of Biodentine in presence of different decalcifying agents using Tukey's Pro-hoc test. It is evident from the table that the comparisons: Q MiX vs. Control, Glyde File Prep vs. Control, 10% Citric Acid vs. Control, 17% EDTA vs. Control and Saline vs. Control showed statistically significant difference of means, while the strengths using different agents were statistically insignificant.

DISCUSSION

The goal of an ideal endodontic therapy is to hermetically secure all pathways ofcommunication between the pulp and periodontium.[Mathew 2016] One of the mishaps that may occur during endodontic therapy is perforation of the root canal wall or furcation perforation which can occur due to caries or resorption or occur during endodontic treatment or may occur during post-space preparation [Singh 2016, Alzraikat 2016]. Perforations have been reported to occur in 2-12% of cases [Ramazani 2016].

Biodentine™ (Septodont, St.Maur-des-Fossés, France) is a bioactive calcium silicate cement. It is used for the repair of root perforations, apexification and root end filling [Alzraikat 2016]. It contains tricalcium silicate, calcium carbonate, and zirconium oxide, and a water-based liquid which contains calcium chloride as the setting accelerator and a waterreducing vehicle [Zhou 2013].

An ideal perforation repair material must provide a tight seal between the oral environment and periradicular tissues. It must also remain in place under dislodging forces [Singh 2016]. The material should resist displacement forces acting upon it. The high-bond strength of material to the root dentin via micromechanical retention or frictional resistance is strategic in maintaining the state of coherence of the cement-dentin interface. [14] The push-out test aims to evaluate the bond strength of a restorative material to dentine [Cechella 2015] hence in the present study push out test was done to evaluate the bond strength of Biodentine.

In the present study the mean bond strength of Biodentine was 9.94 MPa ± 2.16 MPa (Table 2). It is similar to the finding of Cechella B. *et al* who reported the mean bond strength of Biodentine after 24 hours was 8.06 ± 3.14 MPa. [Cechella 2015] Uzunoglu E. *et al* found lesser bond strength values of Biodentine during manual mixing (4.57 ± 1.99 MPa) as compared to mechanical mixing (5.29 ± 1.54 MPa). This may be due to the difference in the thickness of the sample, as they used 1 mm thickness [Uzunoglu 2016]. However these finding are contrary to the findings of Akcay H. *et al* 2016, whose findings reflect lesser bond strength of Biodentine 2.07 ± 0.71 MPa and 4.01 ± 0.88 MPa, in presence and absence of blood respectively [Akcay 2016]. Similar findings were seen by Ustun Y. *et al* 2015 3.58 ± 1.49 MPa and 4.36 ± 2.55 MPa, in presence and absence of blood respectively [Üstün 2015].

In the present study the mean pushout bond strength of Biodentine after being exposed to saline is 6.25 MPa ± 1.94 MPa(Table 2). Saline has negatively influenced the pushout bond strength of Biodentine which is highly significant. It is consistent with the findings of Yakup U. *et al* (2015) [Govindaraju 2016] and Cechella *et al* 2015 who found the mean bond strength values to be 8.50 MPa [Cechella 2015].However it is inconsistent with the findings of previous studies. Govindaraju L. *et al*2016 reported that the compressive strength of Biodentine was significantly higher than thecontrol after being exposed to saline [Govindaraju 2016]. Guneser M. *et al* 2013 reported higher bondstrength of Biodentine as compared to control, however the results were insignificant [Guneser 2013]. It has been reported by manufacturer's that Biodentine should be prevented from exposure to water and fluid during the initial setting. However, in this study, specimens were immersed in saline immediately to simulate the clinical situation. This excessive moisture for Biodentine might hamper the setting reaction resulting in lesser values of bond strength for its separation from the dentine [Üstün 2015, Kim 2015]

In the present study the mean values for 17% EDTA exposed Biodentine are 5.13 ± 1.30 MPa. These findings are similar to the findings of previous authors. Govindaraju L. *et al* 2016 reported that Biodentine showed a reduction in compressive strength following exposure to 17% EDTA, but not with NaOCl. This may be due to its chelating action, which interferes with the formation of calcium silicate hydrate gel [Govindaraju 2016, Lee 2007]. It has been reported by Camilleri J. 2014 that the surface of Biodentine exhibited peaks for calcium and silicon and it leaches high amount of calcium in the immediate vicinity [Camilleri 2014]. However the findings of previous study by Elnaghy A. *et al* 2014, show that 17% EDTA does not affect the compressive strength of Biodentine, which are contradictory to the results of the present study [Elnaghy 2014]. 17% EDTA has been reported to have a strong negative influence on the compressive strength of Biodentine [Govindaraju 2016,Taha 2016,Aggarwal 2011]. 17% EDTA has six potential sites (four carboxyl groups and two amino groups) available to bond with calcium to form highly stable bonds. The residual 17% EDTA in the root canal system may chelate with calcium ions released during hydration and disturb its precipitation(Akman 2016).

In the present study the mean bond strength of Biodentine using 10% Citric Acid was 5.25 ± 2.30 MPa. Previous studies have reported that there is significant decrease in the compressive strength of material after exposure to acidic environment. Results of the present study are in accordance with Akman M. (2015) (Ajas 2016). According to Camilleri J. *et al* Biodentine exhibited both structural and chemical changes when treated with phosphoric acid. The material also exhibited lower calcium to silicon ratio and a reduction in the chloride peak height when treated with acid and showed significant leakage at the dentine to material interface when used as a dentine replacement material in the sandwich technique under composite (Camilleri J 2006, Agrafioti 2015). Literature has indicated that lower pH environments affects the physical and chemical properties of hydraulic cements. Low pH affects the hydration reaction of the material and that the more acidic the surrounding solution during the setting process, the more extensive is the porosity of set material (Agrafioti 2015,Srivastava 2016).

In the present study the mean bond strength of Biodentine after being exposed to QMix ™ 2 in 1 solution was 6.51 ± 1.03 MPa. Elnaghy A. *et al* reported similar findings, the mean push out bond strength of Biodentine after exposure to Q MiX however it was insignificant(Elnaghy 2014). Q MiX is composed of 17% EDTA, CHX, and a surfactant, which consequently enhances the demineralization of radicular dentin due to the chelating effect of 17% EDTA, while disinfecting at the same time (Elnaghy 2014). CHX has a unique property of substantivity, which is the ability to be adsorbed in the dentin and gradually get released over time. In the present study, CHX was used in liquid form as part of Q MiX. Another underlying principle of including surfactant in Q MiX is to lower the surface tension of solution and increase its wettability, thus enhancing the flow of the irrigant into the root canal and its contact with the smear layer and underlying dentin. May also be a reason for reduced bond strength(Elnaghy 2014, 30). High negative significant can be attributed to the presence of 17% EDTA and CHX together having a synergistic effect along with a detergent for better wettability (Elnaghy 2014).

In the present study Glyde File Prep conditioned Biodentine showed mean bond strength to be 5.07 ± 0.83 MPa. Results are in resemblance with the results of previous studies by Yan P. 2006 *et al* where Glyde File Prep had negatively influenced the bond strength (Ramazani 2016). Glyde File Prep is a water-soluble acidic gel containing 15% EDTA and urea peroxide. It has the capability to improve chemomechanical debridement by removing the smear layer when used as a lubricant and chelating agent during the cleaning and shaping of root canals. One of the probable reasons for reduced bond strength after treatment with Glyde File Prep is that, it has the capability to remove the smear layer, which makes it possible to infiltrate into the interfacial layer and interfere the chemical adhesion between hydraulic cement and dentin. Another explanation could be the demineralization effect of Glyde File Prep on Ca-containing materials (Ramazani 2016). It was also suggested that the lower pH derived from the peroxide in Glyde File Prep can affect the surface structure of completely hardened cement. However further studies are required to confirm the findings of the present study.

CONCLUSION

All the final rinse agents decrease the bond strength of Biodentine. However Q Mix showed the least negative influence. Q Mix is advocated as irrigating and final rinse agent in cases of perforation repair with Biodentine as it does not hamper the chemical characteristics and setting of Biodentine.

Acknowledgements

We would like to extend our heartfelt thanks to Mr. Dhananjay Raje (MDS Bioanalytics) for all his assistance provided in statistical analysis.

Refrences

1. Gupta PK, Mahajan UP, Gupta K, Sheela NV. Comparative evaluation of a new endodontic irrigant - mixture of a tetracycline isomer, an acid, and a detergent to remove the intracanal smear layer: A scanning electron microscopic study. *J Int Oral Health* 2015; 7(4):1-6.
2. Kenneth M. Hargreaves, Stephen Cohen. Cohen's Pathways of the pulp. 10thEdition. Restricted South Asia Edition. Kundli, India. *Mosby Elsevier*. 2011.
3. Guneser MB, Akbulut MB, Eldeniz AU. Effect of various endodontic irrigants on the push-out bond strength of biodentine and conventional root perforation repair materials. *J Endod*. 2013;39(3):380-4.
4. Aggarwal V, Singla M, Miglani S, Kohli S. Comparative evaluation of push-out bond strength of ProRoot MTA, Biodentine, and MTA Plus in furcation perforation repair. *J Conserv Dent*. 2013;16(5):462-5.
5. Gutmann JL, Harrison JW. Surgical Endodontics. Boston; Blackwell, 1991; 409 22.
6. Nagas E, Cehreli ZC, Uyanik MO, Durmaz V, Vallittu PK, Lassila LV. Bond strength of mineral trioxide aggregate to root dentin after exposure to different irrigation solutions. *Dent Traumatol*. 2014 Jun;30(3):246-9.
7. Fuss Z, Trope M. Root perforations: classification and treatment choices based on prognostic factors. *Dent Traumatol*. 1996 Dec;12(6):255-64
8. Elnaghy AM. Influence of QMix irrigant on the micropush-out bond strength of biodentine and white mineral trioxide aggregate. *J Adhes Dent*. 2014;16(3).
9. Mathew LA, Kini S, Acharya SR, Kamath S, Menezes ND, Rao S. A comparative evaluation of the microleakage of blood-contaminated mineral trioxide aggregate and Biodentine as root-end filling materials: An in vitro study. *J Interdiscip Dentistry*. 2016;6(1):19-24.
10. Singh S, Podar R, Dadu S, Kulkarni G, Vivrekar S, Babel S. An in vitro comparison of push-out bond strength of Biodentine and mineral trioxide aggregate in the presence of sodium hypochlorite and chlorhexidine gluconate. *Endodontology 2*016;28:42-5.
11. Alzraikat H, Taha NA, Salameh A. A comparison of Physical and Mechanical Properties of Biodentine and Mineral Trioxide Aggregate. *J Res Med Den Sci*. 2016;4(2):121-6.

12. Ramazani N, Sadeghi P. Bacterial leakage of mineral trioxide aggregate, calcium-enriched mixture and biodentine as furcation perforation repair materials in primary molars. *Iran Endod J.* 2016;11(3):214.
13. Zhou HM, Shen Y, Wang ZJ, Li L, Zheng YF, Häkkinen L, Haapasalo M. In vitro cytotoxicity evaluation of a novel root repair material. *J Endod*. 2013;39(4):478-83.
14. Akcay H, Arslan H, Akcay M, Mese M, Sahin NN. Evaluation of the bond strength of root-end placed mineral trioxide aggregate and Biodentine in the absence/presence of blood contamination. *Eur J Dent.* 2016;10(3):370-5.
15. Cechella BC, Almeida JD, Felippe MC, Teixeira CD, Bortoluzzi EA, Felippe WT. Influence of phosphate buffered saline on the bond strength of endodontic cement to dentin. *Braz J Oral Sci*. 2015;14(2):126-9.
16. Uzunoglu E, AktemurTurker S, Uyanik MO, Nagas E. Effects of mixing techniques and dentin moisture conditions on push-out bond strength of ProRoot MTA and Biodentine. *J Adhes Sci and Techno*l. 2016;30(17):1891-8.
17. Üstün Y, S. Topçuoğlu H, Akpek F, Aslan T. The effect of blood contamination on dislocation resistance of different endodontic reparative materials. *J Oral Sci*. 2015;57(3):185-90.
18. Govindaraju L, Neelakantan P, Gutmann JL. Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements. *Clin Oral Investig*. 2016:1-5.
19. Kim JR, Nosrat A, Fouad AF. Interfacial characteristics of Biodentine and MTA with dentine in simulated body fluid. *J Dent.* 2015;43(2):241-7.
20. Lee YL, Lin FH, Wang WH, Ritchie HH, Lan WH, Lin CP. Effects of EDTA on the hydration mechanism of mineral trioxide aggregate. *J Dent Res*. 2007;86(6):534-8.
21. Camilleri J. Hydration characteristics of Biodentine and Theracal used as pulp capping materials. *Dent Mater J*. 2014;30(7):709-15.
22. Taha NA, Safadi RA, Alwedaie MS. Biocompatibility Evaluation of EndoSequence Root Repair Paste in the Connective Tissue of Rats. *J Endod*. 2016;42(10):1523-8.
23. Aggarwal V, Jain A, Kabi D. In vitro evaluation of effect of various endodontic solutions on selected physical properties of white mineral trioxide aggregate. *Aust Endod J*. 2011;37(2):61-4.
24. Akman M, Akbulut MB, Güneşer MB, Eldeniz AÜ. Effect of intracanal medicaments on the push-out bond strength of Biodentine in comparison with Bioaggregate apical plugs. *J Adhes Sci Technol*. 2016;30(5):459-67.
25. Ajas A, Babu A, Varughese JM, Amal S, Thaha KA. Biodentine - An Alternative to MTA. *Arch of Dent and Med Res* 2016;2(1):26-33.
26. Camilleri J, Pitt Ford TR. Mineral trioxide aggregate: a review of the constituents and biological properties of the material. *Int Endod J*. 2006;39(10):747-54.
27. Agrafioti A, Tzimpoulas N, Chatzitheodoridis E, Kontakiotis EG. Comparative evaluation of sealing ability and microstructure of MTA and Biodentine after exposure to different environments. *Clin Oral Investig*. 2015:1-6.
28. Srivastava AA, Srivastava H, Prasad AB, Raisingani D, Soni D. Effect of Calcium Hydroxide, Chlorhexidine Digluconate and Camphorated Monochlorophenol on the Sealing Ability of Biodentine Apical Plug. *J Clin Diagn Res.* 2016;10(6):43-46.

****