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Review Article

EFFECT OF CHLORHEXIDINE AND SODIUM HYPOCHLORITE IRRIGATING SOLUTIONS ON THE PUSH-OUT BOND STRENGTH OF BIODENTINE ROOT REPAIR MATERIAL- A SYSTEMATIC REVIEW

Nitika Tiwari*., Anamika C.Borkar., Anita Sanap., Ujjwal Gupta and Nikhil Nighot

DR. DY. Patil Dental College and Hospital, DR. DY. Patil Vidyapeeth, Pimpri, Pune

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ABSTRACT

Introduction: The operator should immediately repair the furcation perforations with an endodontic material in order to minimize the bacterial contamination and the irritation of periodontal tissues because of the usage of endodontic irrigants. After repairing the furcal perforation, endodontic treatment should be performed with various irrigants including 2% chlorhexidine gluconate (CHX) and sodium hypochlorite (NaOCl) solutions to disinfect the root canal system. However, this procedure causes unavoidable contact of irrigants with the repair materials. Thus, the purpose of this systematic review was to evaluate the effect of various endodontic irrigants on the push-out bond strength of Biodentine root repair material.

Method: Electronic search of PubMed, Google Scholar, Institutional Library, CTRI, Ind Med, Googleand manual search using DPU college library resources. and E-mail to authors revealing information about push-out bond strength of biodentine in contact with chlorhexidine and sodium hypochlorite. All cross reference lists of the selected studies were screened for additional papers that could meet the eligibility criteria of the study.

Results: Total of 5802 articles were searched out of which 10 articles were selected after reading title and abstract. As a second step, full text papers were obtained. However studies in which effect of Chlorhexidine and Sodium Hypochorite on the Push-out Bond Strength of Biodentine root repair material were selected. Finally a total of 10 articles were included out of which 7 articles were excluded on basis of insufficient data and 3 articles were selected for final synthesis.

Conclusion: Push-out bond strength was more when Biodentine was in contact with sodium hypochlorite.

INTRODUCTION

A successful endodontic therapy depends on thorough chemomechanical preparation of root canal system as well as three-dimensional obturation that provides complete sealing of spaces previously occupied by canal contents.[1] Procedural accidents like perforation that occur during endodontic treatment can affect the long term prognosis of the tooth. Root perforation is an artificial communication between the root canal system and the supporting tissues of the tooth or the oral cavity.[2] Perforations in endodontics can occur during:

1. Access preparation
2. Canal location and identification
3. Root canal instrumentation
4. Post space preparation

The perforation normally occurs in the cervical area of the tooth in anterior teeth, or in the furcation area of posterior teeth, as a result of length of the bur being used.[3] Furcation perforation is a procedural complication that can occur during endodontic treatment or post space preparation of teeth (4). An ideal perforation repair material should provide a tight seal between the oral environment and peri radicular tissues. It also should remain in place under dislodging forces, such as mechanical loads of occlusion or the condensation of restorative materials over it (5-8).

Although many dental materials have been tried including amalgam, Cavit (ESPE, Seefeld, Germany),composite resin, glass ionomer cement, calcium hydroxide, Super EBA (Harry J Bosworth, Skokie, IL), intermediate restorative material (IRM; Dentsply DeTrey, Konstanz, Germany), and mineral trioxide aggregate (MTA), most of these materials show significant

Corresponding author:* **Nitika Tiwari
DR. DY. Patil Dental College and Hospital, DR. DY. Patil Vidyapeeth, Pimpri, Pune

shortcomings in one or more of the following areas: solubility, leakage, biocompatibility, handling properties, and moisture incompatibility (9-14).

A variety of new calcium silicate-based materials have been developed recently aiming to improve MTA shortcomings (15,16). Biodentine (Septodont, Saint Maur des Foss_es, 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. Biodentine is recommended for use as a dentin substitute under resin composite restorations and an endodontic repair material because of its good sealing ability, high compressive strengths, short setting time (16, 17), biocompatibility, bioactivity, and biomineralization properties (18, 19).

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Clinically, the operator should immediately repair the furcation perforations with an endodontic material in order to minimize the bacterial contamination and the irritation of periodontal tissues because of the usage of endodontic irrigants (20). After repairing the furcal perforation, endodontic treatment should be performed with various irrigants including 2% chlorhexidine gluconate (CHX) and sodium hypochlorite (NaOCl) solutions to disinfect the root canal system (21). However, this procedure causes unavoidable contact of irrigants with the repair materials. There is no information about the effect of endodontic irrigants on the push-out bond strength of Biodentine.

Push‑out test is a test to measure the interfacial shear strength developed between different surfaces. It provides information about the adhesive property of the material tested[22] and helps to understand the resistance of the tested material to dislodgement, that is how well the material can bind to the tooth structure. Greater the push‑out strength, greater is the adhesion between the tested material and the tooth surface. In endodontics, the push‑out bond strength is done for root end filling, perforation repair, obturation, and root canal sealer materials, to study their resistance to dislodgement.[23,24]

Thus, the purpose of this systematic review was to evaluate the effect of various endodontic irrigants on the push-out bond strength of Biodentine root repair material.

METHODS

Inclusion criteria

1. Articles in English or those having detailed summary in English.
2. Studies published between 2005-2017
3. In vitro studies providing information on push-out bond strength of Biodentine when in contact with Chlorhexidine and Sodium Hypochlorite.

Exclusion criteria

1. Case reports, abstracts, letters to editors, editorials and animal studies.
2. Human studies.

PICO

P - Participants: Extracted human teeth.
I - Intervention: Chlorhexidine
C - Comparison: Sodium Hypochlorite
O - Outcomes: Push out bond strength

Sr. No.	Search strategy	Number of articles	Number of selected articles	After Duplicate Removal
Search Strategy 1	Biodentine AND push-out bond strength AND chlorhexidine	1	1	1
Search Strategy 2	Biodentine AND push-out bond strength AND sodium hypochlorite	2	2	1
Search Strategy 3	Biodentine AND push-out bond strength AND chlorhexidine AND sodium hypochlorite	1	1	1
Search Strategy 4	Biodentine OR root repair material AND push out bond strength AND chlorhexidine OR irrigants	1930	1	1
Search Strategy 5	Biodentine OR root repair material AND push out bond strength AND sodium hypochlorite OR irrigants	1932	1	1
Search Strategy 6	Biodentine OR root repair material AND push out bond strength AND sodium hypochlorite OR irrigants AND chlorhexidine or irrigants	1930	1	1

Two Internet sources of evidence were used in the search of appropriate papers satisfying the study purpose: the National Library of Medicine (MEDLINE PubMed) and the Cochrane Central Register of Controlled Trials (CENTRAL), Google Scholar, Google, Clinical trials registry and manual search using DPU college library resources. All cross reference lists of the selected studies were screened for additional papers that could meet the eligibility criteria of the study. The databases were searched up to and including 2017 using the search strategy.

METHOD

Preliminary screening consisted total of 5802 articles out of which 5792 articles were selected. The papers were screened independently by two reviewers. At first the papers were screened by title and abstract. As a second step, full text papers were obtained when they fulfilled the criteria of the study aim. Any disagreement between the two reviewers was resolved after additional discussion. For full-text screening, the following criteria were taken into consideration: In-vitro studies done on human extracted teeth in which Effect of Chlorhexidine and Sodium Hypochorite on the push-out Bond Strength of Biodentine root repair material.

Finally a total of 10 articles were included out of which 3 articles was finally synthesized in this systematic review.

Data Collection Process

A standard pilot form in excel sheet was initially used and then all those headings not applicable for review were removed. Data extraction was done for one article and this form was reviewed by an expert and finalized. This was followed by data extraction for all the articles.

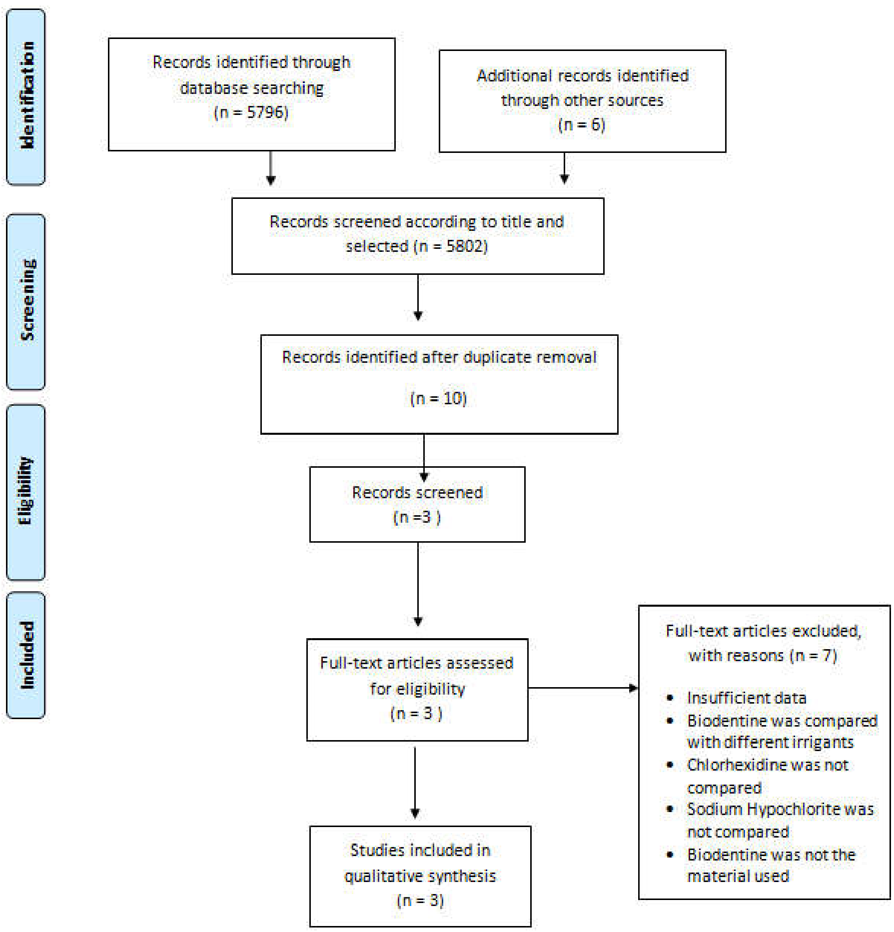
RESULT

DISCUSSION

A successful endodontic therapy depends on thorough chemo-mechanical preparation of root canal system as well as three-dimensional obturation that provides complete sealing of spaces previously occupied by canal contents.[1] Procedural accidents like perforation that occur during endodontic treatment can affect the long term prognosis of the tooth. Root perforation is an artificial communication between the root canal system and the supporting tissues of the tooth or the oral cavity.[2]

STUDY SELECTION

PRISMA 2009 Flow Diagram



The operator should immediately repair the furcation perforations with an endodontic material in order to minimize the bacterial contamination and the irritation of periodontal tissues because of the usage of endodontic irrigants. After repairing the furcal perforation, endodontic treatment should be performed with various irrigants including 2% chlorhexidine gluconate (CHX) and sodium hypochlorite (NaOCl) solutions to disinfect the root canal system. However, this procedure causes unavoidable contact of irrigants with the repair materials.

Biodentine proved to be a very biocompatible material and showed higher push-out bond strength. Push-out bond strength of Biodentine did not vary when exposed to various endodontic irrigants. The biomineralization ability of Biodentine, most likely through the formation of tags, may be the reason of the dislodgement resistance. Han and Okiji (14) showed that calcium and silicon ion uptake into dentin leading the formation of tag-like structures in Biodentine was higher.

The effect of various endodontic irrigants on the push-out bond strength of Biodentine (Septodont, Saint Maurdes Foss_es, France) in comparison with contemporary root perforation repair materials. They have sectioned midroot dentin of canine teeth was horizontally into 1-mm-thick slices. The canal space of each dentin slice was enlarged with a diamond bur to 1.4 mm in diameter. The samples were divided into 5 groups (n =40), and the following materials were placed, respectively: Biodentine, ProRoot MTA (Dentsply Tulsa Dental,Tulsa, OK), amalgam, Dyract AP (Dentsply DeTrey, Konstanz, Germany), and intermediate restorative material (IRM, Dentsply DeTrey). The samples were wrapped in wet gauze for 10 minutes and divided into 3 subgroups (n = 10) to be immersed into 3.5% NaOCl, 2% CHX, or saline for 30 minutes. No irrigation was performed in the controls (n = 10), and a wet cotton pellet was placed over each test material. After incubation for 48 hours, the dislodgement resistance of the samples was measured using a universal testing machine. The samples were examined under a stereomicroscope to determine the nature of the bond failures. Results were as follows Biodentine showed significantly higher push-out bond strength than MTA ($P < .05$). The statistical ranking of push-out bond strength values was as follows: Dyract AP > amalgam $ IRM $ Biodentine > MTA. The push-out bond strength of Dyract AP, amalgam, IRM, and Biodentine was not significantly different when immersed in NaOCl, CHX, and saline solutions, whereas MTA lost strength when exposed to CHX. They concluded Biodentine showed considerable performance as a perforation repair material even after being exposed to various endodontic irrigants, whereas MTA had the lowest push-out bond strength to root dentin. (J Endod 2013; 39:380-384)

Another study to evaluate the push-out bond strength of Biodentine and MTA Plus root perforation repair materials after irrigation with different endodontic irrigants. They have taken Forty freshly extracted single-rooted maxillary canines. The teeth were decoronated at the cementoenamel junction using a water-cooled low-speed diamond disc. Midroot dentin was sectioned horizontally into slices by using a water-cooled low-speed diamond disk. The space of the canal was enlarged with a diamond bur. The root sections were randomly divided into two groups - Group I: Biodentine; Group II: MTA Plus. Then the samples were wrapped in a wet gauze and placed in an incubator. Immediately after incubation, the samples were divided into three subgroups to be immersed into irrigating solutions - Group I: NaOCl; Group II: saline; Group III: CHX. The push-out bond strength values were measured by using a universal testing machine. The nature of bond failure was assessed under a stereomicroscope. One specimen from each group was randomly chosen for scanning electron microscopic examination. Results were as follows Biodentine showed significantly higher push-out bond strength than MTA Plus. They concluded Biodentine showed considerable performance as a perforation repair material even after being exposed to various endodontic irrigants, whereas MTA Plus had the lowest push-out bond strength to root dentin.

In Studies done by few researchers, they compared the push□out bond strength of Biodentine (Septodont, Saint Maur des Fosses, France) and mineral trioxide aggregate (MTA) (Angelus, Londrina, PR, Brazil) when treated with 3% NaOCl and 2% CHX. They have taken Forty□six single canal premolars for this study, and the canal spaces were prepared with #5 Gates glidden drill (1.3 mm diameter). The dentin of these teeth was horizontally sectioned into 1□mm□thick slices at the mid□root level. The samples were divided into two groups (n = 20). Biodentine and MTA were placed into the canal space of dentin slices. The samples were wrapped in wet gauze for 10 min and divided into two subgroups (n = 10) to be immersed into 3% NaOCl and 2% CHX for 30 min. No irrigation was performed in the controls (n = 3). After incubation for 48 h, the dislodgement resistance of the samples was measured using a universal testing machine. The samples were examined under a stereomicroscope to determine the nature of the bond failures. Results were as follows Biodentine showed significantly higher push□out bond strength than MTA ($P < 0.05$) in the presence of both NaOCl and CHX. Within the MTA group. They concluded that push□out bond strength is the force needed for the displacement of the dental material tested. The various irrigants used during the root canal therapy may increase or decrease the push□out bond strength of a material.

Future Implications: Further in vitro and in vivo study required with larger sample size for better comparisons.

CONCLUSION

Within the limitation of this study, it can be concluded that the force needed for the displacement of Biodentine from root dentin was significantly high. Hence, NaOCl and CHX did not influence the resistance to the dislodgement of Biodentine. Biodentine also displayed a remarkably consistent performance even after exposure to NaOCl, CHX, and saline solutions despite the affected surface morphology in the present study. The alteration on the physical properties of Biodentine in CHX solution should be studied further before advocating the clinical application of Biodentine successively with CHX.

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