Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 9, Issue, 07, pp.54923-54927, July, 2017

ISSN: 0975-833X

RESEARCH ARTICLE

EVALUATION OF LEAKAGE OF BLEACHING AGENT THROUGH DIFFERENT INTRAORIFICE BARRIERS IN INTRACORONAL BLEACHING TECHNIQUE- AN IN VITRO STUDY

[1,*]Dr. Shristhi Sharma, [2]Dr. Anant Raghav Sharma, [3]Dr. Shanti Prasad Maurya, [4]Dr. Sonali Chhabria and [5]Dr. Rajrani Sharma

[1]MDS, MBA, Senior lecturer, Department of Conservative Dentistry and Endodontics, Pacific Dental College and Research Centre, Bhillo Ka Bedla, Udaipur, India
[2]MDS, Reader, Department of Periodontology, Pacific Dental College, Debari, Udaipur, India
[31]MDS, Senior lecturer, Department of Dentistry, J L N medical college and hospital, Ajmer,India
[4] Senior lecturer, Department of Prosthodontics, Pacific Dental College and Research Centre, Bhillo Ka Bedla, Udaipur, India
[5] MS, FICOG, Professor and HOD, Department of Obstetrics and Gynaecology, Pacific Medical College, Udaipur, India

ARTICLE INFO

Article History:
Received 26th April, 2017
Received in revised form
18th May, 2017
Accepted 18th June, 2017
Published online 31st July, 2017

Key words:
MTA,
Biodentine,
SDR composite,
Walking bleach,
Bleaching agents.

ABSTRACT

The intracoronal bleaching procedure is largely used because it is efficient, simple and economic. Indications for internal bleaching are discoloration of pulpal origin, dentin stains, and stains not amenable to extra-coronal bleaching. Contraindications to internal bleaching are superficial enamel stains, defective enamel formation, severe dentin loss, presence of caries and discolored composites. Most bleaching agents are oxidizers that act on organic structures of the hard tissues and degrade them into smaller molecules that are lighter in color such as CO_2, O_2 and H_2O. Comman materials which were used earlier are glass ionomer cement, amalgam, zinc phosphate cement, IRM, zinc polycarboxylate cement, silicate cements. Materials which were used in the study were MTA, Biodentine and SDR composite material as an intraorifice barrier in walking bleach technique. Placement of a barrier like Biodentine over the gutta-percha certainly enhances the seal, prevents the leakage of the bleaching materials and is an esthetic option for intraorifice barrier unlike MTA and SDR composite as use of Biodentine does not cause discoloration. This study was performed in in-vitro conditions, hence long term in-vivo studies are required to check for sealing ability of Biodentine before routine clinical usage.

Citation: Dr. Shristhi Sharma, Dr. AnantRaghav Sharma, Dr. Shanti Prasad Maurya, Dr. Sonali Chhabria and Dr. RajraniSharma, 2017. "Evaluation of leakage of bleaching agent through different intraorifice barriers in intracoronal bleaching technique- an in vitro study", *International Journal of Current Research*, 9, (07), 54923-54927.

INTRODUCTION

Bleaching of discoloured, pulpless teeth was first described in 1864 (Truman), and a variety of medicaments such as chloride, sodium hypochlorite, sodium perborate, and hydrogen peroxide has been used, alone, in combination, with and without heat activation (Howell, 1980). The "walking bleach" technique that was introduced in 1961 involved placement of a mixture of sodium perborate and water into the pulp chamber that was sealed off between the patient's visits to the clinician (Spasser, 1961). Indications for internal bleaching are discoloration of pulpal origin, dentin stains, and stains not amenable to extra-coronal bleaching. Contraindications to internal bleaching are superficial enamel stains, defective enamel formation, severe dentin loss, presence of caries and discolored composites. Most bleaching agents are oxidizers that act on organic structures of the hard tissues and degrade them into smaller molecules that are lighter in color such as CO_2, O_2 and H_2O. Intracoronal bleaching technique is usually associated with two common caustic chemicals, 30-35% hydrogen peroxide (H_2O_2) that is a primary oxidizing agent and sodium perborate, where both would release oxygen. Ten percent carbamide peroxide breaks down to 3% hydrogen peroxide, while 37% carbamide peroxide to approximately, the same amount as for sodium perborate mixed with water. The potential side effects of carbamide peroxide are less severe than the complications associated with hydrogen peroxide, since an indirect release of hydrogen peroxide is expected to occur. Their combination would be synergistic and more effective. The intracoronal bleaching procedure is largely used

***Corresponding author: Dr. Shristhi Sharma,**
Department of Conservative Dentistry and Endodontics, Pacific Dental College and Research Centre, Bhillokabedla, Udaipur, India.

because it is efficient, simple and economic, compared to the prosthetic treatment while external cervical resorption is one of its adverse effects. Research has been conducted to determine if a protective restorative material can be placed in the cervical portion of the tooth to prevent this problem. Comman materials which were used earlier are glass ionomer cement, amalgam, zinc phosphate cement, IRM, zinc polycarboxylate cement, silicate cements etc. Another material which is also used as versatile material is MTA (Mineral Trioxide Aggregate) used in many ways for dental treatments ranging from one step apexification to sealing root perforations. Studies have reported that it causes discoloration of the tooth over a period of time. Recent material which was introduced in the market includes Biodentine. Biodentine is non-toxic and shows no surface discoloration also it exhibits low penetration at enamel/dentin interface. It is easy to use and is an endodontic material of choice nowadays. SureFil® SDR® flow posterior bulk fill flowable base is a one-component, fluoride containing, visible light cured, radiopaque resin composite restorative material. It is designed to be used as a base in class I and II restorations. SureFil® SDR® flow material is placed in 4mm increments with minimal polymerization stress. SureFil® SDR® flow material has a self-levelling feature that allows intimate adaptation to the prepared cavity walls. The purpose of this study is to evaluate the leakage of bleaching agents through 3 different intraorifice barriers (MTA, BIODENTINE and SDR) into the obturated pulp space in intra coronal bleaching.

Objectives were:

- To evaluate which is the most suitable intraorifice barrier to be used in walking bleach technique.
- To compare which barrier material leaked the most thereby increasing the risk of external cervical root resorption.

MATERIALS AND METHODS

Fourty freshly extracted, intact non-carious and unrestored human maxillary central incisor teeth were collected from the Department of Oral Surgery, Pacific Dental College, Udaipur and stored in formalin until used. After cleaning all the teeth from calculus and surface deposits, the selected specimens were used within a month of extraction and storage.

Groups included in the study:

GROUP I- BIODENTINE group. (10 teeth)
GROUP II- MTA group. (10 teeth)
GROUP III- SDR group. (10 teeth)
GROUP IV- POSITIVE CONTROL group. (5 teeth)
GROUP V- NEGATIVE CONTROL group. (5 teeth)
ENDODONTIC PREPARATION OF THE TEETH:

Access cavity preparation were made on the palatal surfaces of each tooth using a high speed rotary hand piece (NSK, Japan) with an endo access bur (DentsplyMaillefer, Ballaigues, Switzerland). Necrotic pulp tissue was removed with a barbed broach. Number 10 - K file was placed in the canal to establish the patency of the foramen. The root canals were prepared 1 mm short of the apex. The instrumentation of the canal involved circumferential filing. During debridement process copious amount of 5.25% sodium hypochlorite and normal saline were alternatively used to irrigate the canal in between the change of file size. Canals were then cleaned and dried with absorbent paper points and obturated using lateral condensation with guttapercha and AH plus sealer.

GROUP I, II and III:-Biodentine, MTA and SDR group

The obturated pulp space guttapercha was removed at a level of 3 mm below the cementoenamel junction, followed by the placement of BIODENTINE, MTA, SDR as a cervical base material and the pulp chambers of all the specimens were cleaned and temporized with IRM temporary cement.

GROUP IV:- Positive control group

In positive control group, preparation and obturation was performed as with the experimental groups. No intraorifice barrier material was placed over the guttapercha. A cotton pellet soaked with distilled water was placed into the chamber and temporized.

GROUP V:- Negative control group

In negative control group preparation and obturation were performed as with the experimental groups. The entire access opening were temporized with IRM. Storage of all the teeth was done at ± 37°C and 100% relative humidity for a day, followed by the removal of temporary filling and the pulp chambers of all the specimens were flooded with 17% EDTA for 3 minutes, later rinsed within 5 ml of saline and dried with cotton pellets. All root surfaces and crowns of both experimental groups and positive controls were covered with 2 layers of nail varnish followed by 2 layers of sticky wax, leaving only the access openings uncovered. Teeth in the negative control group were covered completely with sticky wax. The specimens received the bleaching material in the pulp chamber (a paste of sodium perborate i.e. 0.15g and 30% hydrogen peroxide 0.05ml), followed by the temporization with IRM of the access cavity, and then stored at a temperature of ± 37°C and 100% relative humidity for 3 days in an incubator. This bleaching procedure was repeated 3 times in a period of 3 weeks. The pulp chamber was cleaned with 5ml of distilled water, dried and filled with a calcium hydroxide paste for 14 days, followed by the removal of the coronal seal and irrigated with 10 ml of saline solution. All teeth were immersed in Rhodamine B dye for 48 hours. The sticky wax was removed following dye exposure. After a 4-hour running water wash, the specimens were kept moist in gauze sponges.
Teeth were subjected to vertical sectioning with a diamond disc and micromotorhandpiece and split with the help of chisel. Measurement of the maximum point of coronal dye penetration from the CEJ was evaluated with an optical stereomicroscope at an objective of 3X and eyepiece of 10X with a field of view of 6.7mm.

Scoring for dye penetration for marginal micro leakage on the root canal wall:

0 - No dye penetration
1 – Dye penetration in coronal one third
2- Dye penetration in middle one third
3 – Complete dye penetration

The mean measurement of readings on both mesial and distal walls was recorded for each tooth. Statistical analysis of the data was performed using One Way Analysis of Variance (One Way ANOVA) and Post Hoc (Bonferroni) tests. P value of less than 0.05 was considered statistically significant.

Figure 1. MTA and Biodentine

Figure 2. SDR Composite

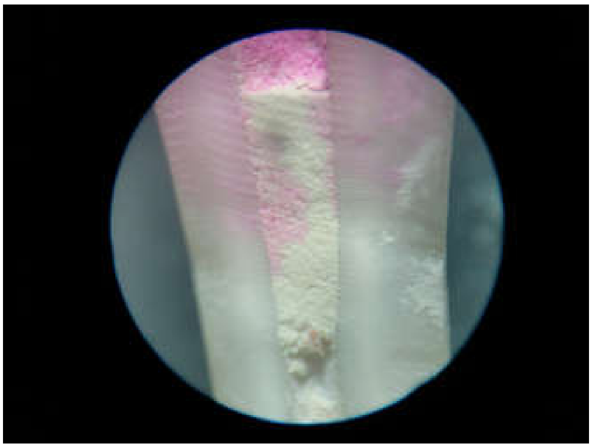


Figure 3. Biodentine sample

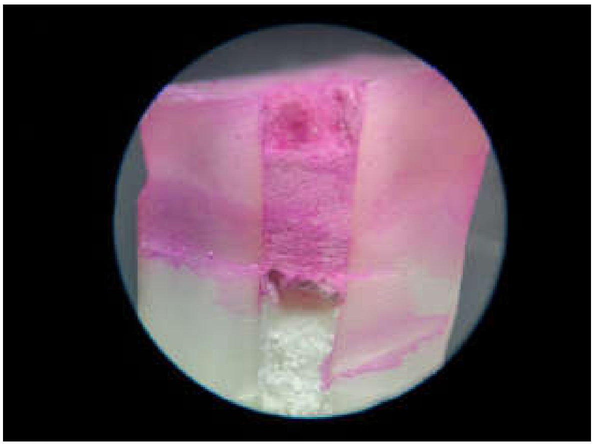


Figure 4. MTA sample

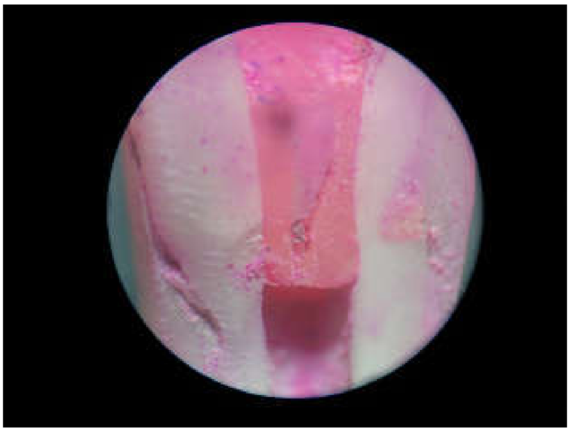


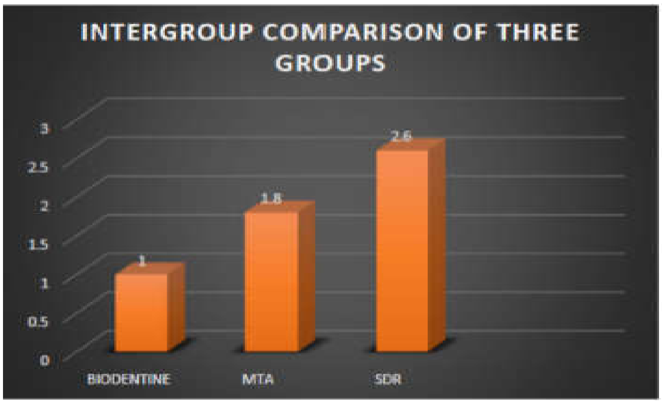
Figure 5. SDR sample

Statistical Analysis

The data were arranged systemically and information was transferred onto the master chart created in Microsoft Excel (2010) for the purpose of data analysis. Analysis of data was performed by applying Statistical software namely SPSS (version 15). Results are expressed as mean and standard deviation. One way ANOVA was used for multiple comparisons followed by Post Hoc Tukey test for group comparison. Intragroup comparisons were done by paired ‘t’ test. For all the test ‘p’ value of 0.05 or less was considered for statistical significance. The difference was significant between BIODENTINE and MTA also between BIODENTINE and SDR. The difference was comparable but not significant between MTA and SDR. All the samples in positive control group leaked and no leakage was seen in negative control group.

Table 1. Indicates the intergroup comparison of the following groups

S No.	Groups	Mean ± SD	P Value
1.	Biodentine v/s MTA	1.00 ± 0.667 1.800 ± 0.789	0.00083
2.	Biodentine v/s SDR	1.00 ± 0.667 2.600 ± 0.516	0.00342
3.	MTA v/s SDR	1.800 ± 0.789 2.600 ± 0.516	0.586698



DISCUSSION

Intracoronal bleaching of discolourednonvital teeth is an important procedure in endodontics and esthetic dentistry. Intracoronal bleaching can serve as a conservative alternative to full coverage or laminate veneer techniques in the treatment of the discolouredpulpless teeth. Intracoronal bleaching technique recommends removal of guttapercha 3mm apical to the cemento enamel junction allowing the bleaching agent to diffuse into dentinal tubules to lighten the cervical 3rd of the crown. The combination of bleach placed below cemento enamel junction and a potential defect at the cemento enamel junction may allow the bleaching agent to leach through the patent dentinal tubules into the periodontal ligament space below the epithelial attachment. Thus an inflammatory reaction ensues that can cause external root resorption at the cervical level of the tooth. The most common hypothesis is that bleaching chemicals diffuse from the pulp chamber or pulp space through patent dentinal tubules to the surrounding periodontal tissues. Several reports have been published regarding various cervical base materials for walking bleach techniques. Glass ionomer cement is a popularly used intraorifice base material in walking bleach technique. However, there are few reports on the capabilities of various cervical base or filling materials to provide an adequate seal during the walking bleach procedure. This study used Rhodamine-B dye as it has small particle size, better penetration, water solubility, diffuse ability, and hard tissue non reactivity.

To date, no material has been found to satisfy all the requirements of an ideal barrier material. MTA has been a choice for perforation repair because it provides optimal biologic conditions for repair and also proliferation of cement oblasts, fibroblasts, and osteoblasts. In addition to its biological properties, MTA presents excellent sealing ability, which was demonstrated by in vitro studies involving dye infiltration, bacteria, and endotoxins due to which it is used in walking bleach technique. Recent study by K. M. Barrieshi-Nusair *et al*. compared MTA and various forms of GI in repairing furcal perforations and bases, and concluded that MTA leaked significantly less than GI. The results of our study are also in conjugation with the above mentioned studies as MTA in the present study behaved superiorly compared to SDR flow able composite. Biodentine is the first all-in-one bioactive and biocompatible dentine substitute based on unique Active BiosilicateTechnology™ and designed to treat damaged dentine both for restorative and endodontic purposes. Compared to other calcium based cements, this material presents two advantages: i) a faster setting time of about 12 minutes and ii) higher mechanical properties. These physico-chemical properties associated with the biological behaviour suggest that it may be used as a permanent dentine substitute.
Clinical Applications of Biodentine include indirect pulp capping, direct pulp capping, partial pulpotomy, apexification, repair of perforations and a root end filling material. Ankita Khandelwal *et al*. checked for marginal adaptation of three root filling materials GIC, MTA and Biodentine and concluded that lowest marginal gaps and good marginal adaptation was seen with Biodentine followed by MTA and maximum marginal gaps were seen with GIC. In our study, two samples in Group I (Biodentine) did not exhibit any leakage and only two samples showed leakage till middle third region and the remaining 6 samples showed the least leakage value (1.00 mm) when compared with other experimental groups, especially MTA. Also the samples of Group II (MTA), exhibited more leakage than Biodentine which was in correlation with the study done by Ankita Khandelwal *et al*. In our study, two samples showed complete leakage however most of the others had leaked till the middle third and there was a statistically significant difference between Biodentine, MTA and SDR Composites. SureFil® SDR® flow material has a self-levelling feature that allows intimate adaptation to the prepared cavity walls and thus this is a suitable alternative barrier material during intracoronal bleaching technique. It is designed to be overlayed with a methacrylate based universal/posterior composite for replacing missing occlusal/facial enamel. SDR™ has a number of significant advantages over the conventional composite build-up technique. SDR™ material possesses a high depth of cure and degree of conversion that optimizes physical and mechanical properties. As a result of these exceptional properties, SDR™ material is the 1st flowable composite base (injectable delivery system) suitable for bulk (4 mm) placement in Class I and II cavities, which can result in time savings of up to 30% over traditional restorations and hence was used in the present study as intraorifice barrier.

In Group III (SDR composite) of our study most of the samples showed complete leakage excluding 4 samples which had leakage till middle third region. SDR leaked more in comparison to MTA but the difference was not statistically significant. Hence, the results of present study could be compared with the study done by Yavari *et al*., though not in complete aggrement. In the present study the probable reasons that Biodentine showed superior results compared to MTA could be because:

- When Biodentine comes in contact with dentine it leads to the formation of tag-like structures alongside an interfacial layer called the “mineral infiltration zone”. The alkaline-caustic effect of calcium silicate cement hydration products degrades the collage nous component of interfacial dentine & improves the sealing ability of Biodentine through the formation of tags.
- Smaller particle size of Biodentine adapts well to cavity surface sealing the interface.
- Biodentine has an advantage of fast setting time (12 min) thereby sealing the interface earlier and avoids further leakage hence there is a lower risk of bacterial contamination.

Also the porosity and pore volume in set Biodentine material is also lesser than MTA. MTA may have shown little inferior results in this study due to the use of rhodamine B which has small particle size, better penetration, water solubility, and diffusability. Use of SDR as an intraorifice barrier showed results comparable but inferior to MTA. Placement of a barrier like Biodentine over the gutta-percha certainly enhances the seal, prevents the leakage of the bleaching materials and is an esthetic option for intraorifice barrier unlike MTA as use of Biodentine does not cause discoloration. This study was performed in in-vitro conditions, hence long term in-vivo studies are required to check for sealing ability of Biodentine before routine clinical usage. Further studies need to be done to check for nature and longevity of the bond obtained from dentine – Biodentine interface and on the effect of blood contamination on sealing ability of Biodentine. Also long term effects of discoloration of Biodentine clinically has to be evaluated.

Conclusion

- Placement of the barrier is mandatory to prevent or minimize cervical resorption in walking bleach technique.

- Biodentine showed the least dye leakage proving that it is the most suitable material to be used as an intraorifice barrier material.
- SDR composite leaked the most but compared to other nanohybrid composites in literature SDR performed well due to its superior adaptation property.
- MTA leaked lesser than SDR but not statistically significant.
- The minimal leakage values were observed with Biodentine, followed by MTA and lastly by SDR composite.
- As the literature review suggests that MTA discolors when it comes in contact with blood and endodontic irrigants, Biodentine can be considered as a viable alternative in walking bleach technique.

REFERENCES

A Review on Biodentine, a Contemporary Dentine Replacement and Repair Material. ÖzlemMalkondu, MeriçKarapinarKazandağBioMed Research International Volume 2014, 2015,103-109.

Abdel moumen *et al*., 2015. Use of Biodentine™ in the Treatment of Invasive Cervical Resorption: A Case Report. *IJRD*, Issue 1.

AnkitaKhandelwal, J. Karthik, Roopa R. Nadig, 2015. Sealing ability of mineral trioxide aggregate and Biodentine as the root end filling material, using two different retro preparation techniques - An in vitro study. *International Journal of Contemporary Dental and Medical Reviews,* 202-205.

Barrieshi-Nusair, K. M., H. M. Hammad, 2014. Intracoronal sealing comparison of mineral trioxide aggregate and glass Ionomer, Volume 36, Number 7, July/August, Quintessence International.

Biodentine: A Promising Dentin substitute Harpreet Singh, Mandeep Kaur. Interdisciplinary Medicine and Dental Science (2015) 202-205.

Cervical root resorption and nonvital bleaching. Nikhil Bahuguna Endodontology Volume: 25 Issue 2 December 2013.

Clinical Investigation of Nano-hybrid Resin Composite Lined with Smart Dentin Replacement Flowable Resin Composite, Ann-Christin Meier. *Mansoura Journal of Dentistry,* 2015; 1(3):96-100.

Dr. AnnemieGrobbink, Amsterdam, 2015. Replacement of amalgam restorations using the SDR™ filling technique, Dynamics edition, Dentsply.

In Vitro Assessment of a Gel Base Containing 2% Chlorhexidine as a Sodium Perborate's Vehicle for intracoronal Bleaching of Discolored Teeth Daniel Pinto de Oliveira „*JOE*—Volume 32, July 2006.

Lim, M. Y., S. O. Y. Lim, R. S. C. Poh, G. P. Lee & K.C. Li, 2004. An in vitro comparison of the bleaching efficacy of 35% carbamide peroxide with established intracoronal bleaching agents *International Endodontic Journal,* 37, 483–488.

Markus Kaup, Edgar SchäferKaup *et al*. 2015. An in vitro study of different material properties of Biodentine compared to ProRootMTA. *Head & Face Medicine,* 11:16.

Nagaveni, N.B., K.V. Umashankara, 2008. 6 year report of non-vital bleaching. Management of tooth discoloration in non-vital endodontically treated tooth. *Journal section: Clinical and Experimental Dentistry,* 3(2):e180.

Oliveira, L.D., Carvalho, 2003. Sealing evaluation of the cervical base in intracoronal bleaching. *Dental Traumatology,* 19:309-313.

Pankaj Kumar Gupta, 2015. Evaluation of Sealing Ability of Biodentine as Retrograde Filling Material by Using two Different Manipulation Methods: An In Vitro Study. *Journal of International Oral Health,* 2015; 7(7).

Rahmat A. Barkhordar, Daniel Kempler and Octavia Plesh. Effect of nonvital tooth bleaching on microleakage of resin composite restorations. Quintessence international 1997; 28(5): 341-344.

Rotstein, I., Zalkind, M., *et al*. 1991. In vitro efficacy of sodium perborate preparations used for intracoronal bleaching of discolored non-vital teeth. *Endodontology Dental Traumatology,* 7:177-180.

SasanMoghaddame-Jafari, *et al*. 2014. Effect of ProRoot MTA on Pulp Cell Apoptosis and Proliferation In Vitro study. *JOE*, Volume 31, Number 5, May.

****