

A Stereomicroscopic Evaluation of Microleakage with Dye Penetration of Different Intraorifice Barrier Used During Walking Bleach Technique: An-Vitro Study

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ABSTRACT

Background: To evaluate coronal microleakage of MTA, Biodentine, Cention-N and Caviton as intraorifice barrier during nonvital bleaching.

Materials & method- 40 single rooted maxillary anterior teeth were selected and divided in 4 groups. Group 1 – biodentine (n=10), group 2- MTA(n=10), group 3- cention -N(n=10), group 4- caviton(control)(n=10).root canal treatment was performed with cold lateral condensation technique.3mm intraorifice barrier was given with respective material.Teeth were coated with nail varnish. Sodium perborate and hydrogen peroxide were mixed and placed over barrier for 7 days and cycle was repeated for 21 days. Dye penetration was allowed with 2% basic fuschine dye. Sectioning of teeth were done and analysed under 10x magnification in stereomicroscope.

Results –Results showed that there is no significant difference between Biodentine , MTA, Cention – N. But there were more samples with dye penetration in cention-N.

Conclusion – Biodentine and MTA can be both used as intraorifice barrier in non-vital bleaching to prevent its complication.

Keywords: Walking bleach, Biodentine, MTA, Cention – N, dye penetration.

INTRODUCTION

Systemic and local factors can cause intrinsic changes to the tooth surface ¹. The main intrinsic changes related to the endodontic process may result in a serious esthetic complaint. Internal bleaching is widely used to resolve this, as it is a minimally invasive, simple, and cost-effective intervention for discolored nonvital teeth.² Spasser in 1961 described a method of sealing a mixture of

sodium perborate with water into pulp chamber for 1 week. This technique is known as walking bleach technique. Later Nutting and Poe (1963,1967) modified it using combination of 30% hydrogen peroxide and sodium perborate sealed into pulp chamber for week . This two material has synergistic effect and this was known as combination walking bleach technique.³ Although

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these agents are effective in lightening tooth color, their use has been associated with some complications such as the occurrence of root resorption. This problem has led to the recommended core material placement at the orifice of the root canal, directly after the completion of root canal treatment.⁴

The certain mechanism of cervical resorption in bleached teeth has not been explained yet. This is probably caused by the highly concentrated oxidizing agents which diffuse through dentinal tubules and cementum defects and cause necrosis of the cementum, inflammation of the periodontium, and subsequently root resorption.⁵ Because of its low molecular weight, hydrogen peroxide can penetrate through dentin and release oxygen radicals that break the double bonds of the organic and inorganic compounds inside the dentinal tubules. Moreover, some studies have indicated that the PH at the root surface is reduced by intracoronary placement of bleaching pastes. This acidic environment is known to enhance osteoclastic activity leading to cervical root resorption.⁶ Therefore, the use of a protective barrier over the coronal extent of the root canal filling is recommended to prevent leakage of oxygen and heat into the periodontal tissues in the cervical area of the tooth.

With placement of different intraorifice barrier the sealing property of the material may be jeopardized due to the negative effects of bleaching agent. Hence it becomes necessary to check the effects of bleaching agent on intraorifice barrier. Various materials were used as intraorifice barrier like IRM, Glass Ionomer Cement, Composites, Silicate cements etc. other material commonly used in many treatments is Mineral Trioxide Aggregate (MTA), Biodentine, Cention-N.

Studies have shown that MTA causes discoloration over period of time hence other material biodentine has been introduced which is non toxic and shows no discoloration over period of time. Cention N (Ivoclar) is a restorative material with a special patented filler (isofiller) which reduces polymerization shrinkage and microleakage which acts like a compomer or ormocer and is subgroup of composite resin.

The purpose of this study is to evaluate the leakage of bleaching agents through 3 different intraorifice barriers (MTA, Biodentine and Cention-N) into the obturated pulp space in intra coronal bleaching.

MATERIALS AND METHOD

Forty freshly extracted, intact non-carious and unrestored human maxillary anterior teeth were collected 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

- Group 1 – MTA
- Group 2- Biodentine
- Group 3- cention-N
- Group 4- Cavition (control)

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 (Dentsply Maillefer, Ballaigues, Switzerland). Necrotic pulp tissue was removed. 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 was done in step back technique till master apical file of 40-k. During debridement process copious amount of 5% sodium hypochlorite and normal saline were alternatively used to irrigate the canal in between the change of file size. Finally the root canals were cleaned with 17% EDTA followed by normal saline and 5% sodium hypochlorite followed by final rinse with normal saline. Canals were then cleaned and dried with absorbent paper points and obturated using lateral condensation with gutta-percha and RC sealer.

The obturated pulp space gutta-percha was removed at a level of 3 mm below the cemento-enamel junction, followed by the placement of MTA, Biodentine, Cention-N, Cavition as a cervical base material and the pulp chambers of all the specimens were cleaned and temporized with temporary cement.

After 24 hours all the samples received the bleaching agent i.e. Mixture of sodium perborate

tetrahydrate and 30% hydrogen peroxide. And the chamber was sealed again with temporary cement. The samples were stored in normal saline .the process was repeated every 7 days for 21 days.

Later the samples were coated with 2 coats of clear nail varnish and the apex was sealed with sticky wax. Then the samples were immersed in 2% basic fuschine dye for 24 hours. The samples were washed under running water for 30 minutes. The nail varnish coats were scraped and teeth were sectioned with diamond disc and micromotor handpeice in buccolingual direction.

Measurement of dye penetration was done under stereomicroscope of 10x magnification.

Scoring for dye penetration-

- 0-no leakage detected
- 1-leakage extending 1/4th of barrier material
- 2-leakage extending ½ of barrier material
- 3-leakage extending 3/4th of barrier material
- 4- Leakage extending more than 3/4th of barrier material.

The mean measurement of readings was recorded for each tooth. Statistical analysis of the data was performed using Mann – Whitney test and chi square test.

Table 1: GROUP * DATA Crosstabulation

			DATA			Total
			No leakage could be detected.	Leakage extending 1/4th of barrier material	Leakage extending 1/2 of barrier material	
GROUP	MTA	Count	7	3	0	10
		% within GROUP	70.0%	30.0%	0.0%	#####
	Biodentine	Count	8	2	0	10
		% within GROUP	80.0%	20.0%	0.0%	#####
	Cention -N	Count	6	4	0	10
		% within GROUP	60.0%	40.0%	0.0%	#####
	Cavition	Count	3	6	1	10
		% within GROUP	30.0%	60.0%	10.0%	#####
Total		Count	24	15	1	40
		% within GROUP	60.0%	37.5%	2.5%	#####

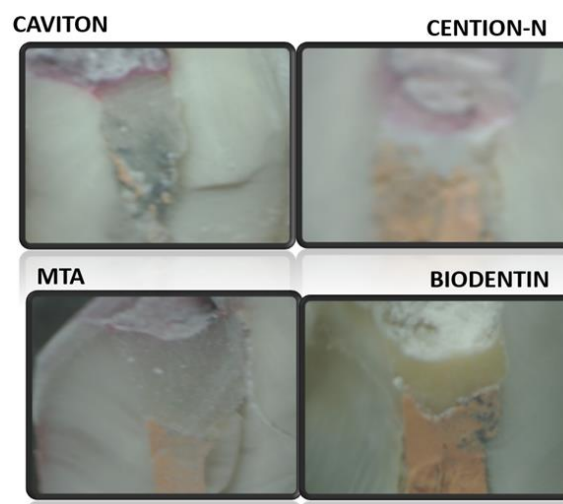


Fig 1: Cross sectional image.

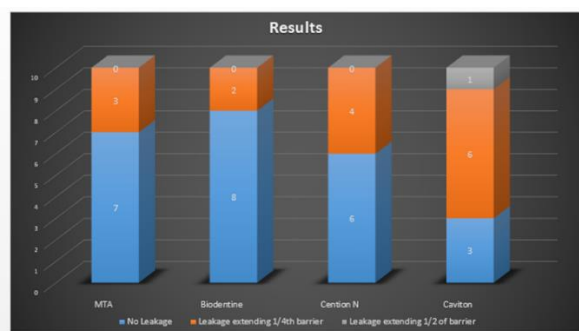
Statistical analysis

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

Results are expressed deviation. Chi square test and Mann whitney U test were performed.For all the test 'p' value of 0.05 or less was considered for statistical significance. The difference was not significant between Biodentine, MTA and cention N. Amongst 3 biodentine showed least dye leakage.

Table 2: Data from Mann Whitney Test

		Mann-Whitney Test P Value
MTA	Biodentine	.615
MTA	Cention -N	.648
MTA	Cavition	.067
Biodentine	Cention -N	.342
Biodentine	Cavition	.025
Cention -N	Cavition	.147



Graph 1: Showing results from different groups.

DISCUSSION

Ideally, the root canal filling material should provide a barrier by itself that prevents bacterial ingress from the oral cavity and travelling down the root canal and to periapical tissues. However, none of the current obturation materials/techniques are capable of providing such a level of seal. Both gutta-percha, in combination with sealers, and the relatively newer adhesive obturation fail to prevent leakage effectively within the root canal system. This problem has led to the recommendation that core materials be placed at the orifice of the root canal directly after the completion of orthograde root canal treatment. Placement of a reliable intraorifice barrier is generally required during intracoronary bleaching of root-filled teeth.

According to Wolcott et al, ideal properties of an intraorifice barrier should include the following characteristics: 1. Easily placed 2. Bonds to tooth structure 3. Seals against microleakage 4. Distinguishable from natural tooth structure 5. Does not interfere with the final restoration.⁷

To date, no material has been found to satisfy all the requirements of an ideal barrier material. 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.⁸ The results of our study are also in conjugation with the above-mentioned studies as MTA in the present study behaved superiorly compared to cention – N.

Biodentine is the first all-in-one bioactive and biocompatible dentine substitute based on unique Active Biosilicate Technology TM 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.^{9,10} 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.¹¹

In Group III (Cention-N) of our study most of the samples showed complete leakage. Cention N leaked more in comparison to MTA but the difference was not statistically significant. 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 collagenous 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.

CONCLUSION

- All the materials showed dye penetration in different percentages
- 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.
- MTA leaked lesser than Cention-N but not statistically significant.
- The minimal leakage values were observed with Biodentine, followed by MTA and Cention N and lastly by cavition.

As the literature review suggests that MTA discolours when it comes in contact with blood and endodontic irrigants, Biodentine can be considered as a viable alternative as intraorifice barrier in walking bleach technique.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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