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Research Article

EVALUATION OF MICROLEAKAGE OF 3 DIFFERENT MATERIALS USED AS INTRA-ORIFICE BARRIER IN ENDODONTICALLY TREATED TEETH: AN IN-VITRO STUDY

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A R T I C L E I N F O

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A B S T R A C T

Objective:-To evaluate Bulk fill composite, Biodentine and Zirconomer as intraorifice barrier to prevent coronal microleakage in root canal treated teeth.
Materials and Methods:- Forty single-rooted mandibular premolars were instrumented and obturated by cold lateral compaction technique. The teeth were randomly divided into three experimental groups according to the materials used: Bulk fill composite, Biodentine and Zirconomer (n=10) and two control groups (n=5). In experimental groups, 3 mm of coronal gutta-percha was removed and replaced with the study material. Samples were submerged in Rhodamine-B dye in vacuum for one week. Specimens were longitudinally sectioned and leakage measured using a 10X stereomicroscope and graded for depth of leakage.
Results:- According to the results of the present study, Bulk fill composite demonstrated better seal ($P < 0.05$) than the other two groups. There was statistical significant ($p<0.05$) difference between Bulk fill composite and Biodentine and also between Biodentine and Zirconomer. There was highly statistical significant ($p<0.001$) difference between Bulk fill composite and Zirconomer.
Conclusions:- Using Bulk fill composite as intraorifice barrier, reduced amount of microleakage was seen as compared to biodentine and Zirconomer.

INTRODUCTION

The concept of coronal leakage having an effect on the outcome of root canal treatment has been known for nearly 90 years.[1] It is considered as one of the most important factors associated with endodontic treatment failures as well as developed or persistent apical periodontitis.[2]

According to Tselnik *et al.* insufficient coronal seal may occur in different clinical situations, like fracture of tooth structure, missing of temporary filling materials, delay in placing a permanent restoration, marginal leakage of the final and temporary restoration and recurrent caries. All these conditions account for 59.4% of endodontically treated teeth .[3]

Ray and Trope found that the quality of coronal restoration might be a more important factor than quality of the root canal obturation.[4]Therefore, every effort should be made to prevent microbial contamination of the pulp space.[5] Thus, the addition of a coronal seal for root canal fillings has been recommended.[6] With this animus,comes the concept of intra-orifice barriers.

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Intra-orifice barrier is a relatively recent technique to decrease coronal leakage in endodontically treated teeth. It basically involves placing additional material into the canal orifices, immediately after removal of the coronal portion of gutta-percha and sealer.[7]

According to Roghanizad and Jones[8], Carmen and Wallace[9], after endodontic therapy, use of intraorifice barrier materials and sealing pulp chamber with the adhesive systems provides a second line of defense to bacteria.

In this respect, many materials were investigated and compared for their effective sealing ability at the canal orifices using different methodologies. Of these materials, Amalgam, Geristore (compomer), Fuji-plus, MTA, Tetric flow, glass ionomer cement, resin modified glass ionomer cement, Cavit G, IRM and Super EBA were all examined.[10]

Generally, none of the previously investigated materials were capable of complete or prolonged abolishing of leakage with varying degrees. Therefore, the aim of the present study was to investigate the sealing ability of 3 orifice bonding materials-namely Bulk fill composite, Zirconomer and Biodentine. The null hypothesis to be tested is that all experimented materials placed in the orifice leak to same extent.

MATERIALS AND METHOD

40 single rooted mandibular premolar teeth, with type I canal system, stored at 100% humidity were collected for the study. Roots with cracks, open apices, resorptive defects, large carious lesion and curved roots were excluded. After the removal of debris, calculus and soft tissues from the root surface, the crowns were decoronated at the cementoenamel junction using diamond disc, under copious water cooling to a standardized length of 13 mm. A #10 K file (Dentsply, Maillefer, Ballaigues) was introduced and visualized, until it reached the apex of the tooth. 1mm was reduced from this length and working length was established. Instrumentation was started with protaper SX to enlarge the orifice, followed by S1, S2, F1,F2,F3 in a sequential manner in a crown-down technique . Irrigation was done simultaneously with 5.25% NaOCl and 17% EDTA. After the culmination of instrumentation , the canals were rinsed with 2 ml of 5.25% NaOCl followed by 2 ml of 17% EDTA and a final rinse with 0.2% chlorhexidine . Later, the canals were dried with paper points and obturated with 0.06% guttapercha and AH plus sealer by lateral compaction technique .Guttapercha was removed from the coronal 3 mm using #5 Gates Glidden drills to have a uniform diameter of 1.3 mm and the depth was confirmed with a periodontal probe .

These 40 samples were divided into 3 experimental groups, containing 10 samples each and remaining 10 teeth were divided equally into positive and negative control groups.

Group	Intra Orifice Barrier Placed
I	Bulk Fill Composite (IvoclarVivadent)
II	Zirconomer (Shofu)
III	Biodentine (Septodont)
IV	Control Group

The materials mentioned in the Table were placed into the orifice, 10 samples belonging to each group , according to the manufacturer's instruction.

Group I:- Root canal orifices were etched with 37% phosphoric acid for 15-20 seconds , followed by rinsing with water and excess water was removed . Then Tetric N bond adhesive (IvoclarVivadent) was applied for 20 seconds and light cured. Finally, placement of Bulk fill composite is done and cured for 40 seconds.

Group II:- The specified amounts of powder and liquid were dispensed onto the paper pad in the ratio of 3:1, powder being divided into two equal parts. The first portion was mixed into the liquid with agate spatula and the second portion was added into the remaining liquid. Mixed GIC was placed and compacted into the canal orifices.

Group III:-The premeasured powder containingcapsule and liquid were taken. The liquid was poured into the capsule and the components were triturated to obtain a consistent mix. Later, the mixture was placed into the orifices.

All the materials were kept in a coded container and stored in 100% humidity at 37^{o} C for 48 hours to allow the materials to set completely .Three coats of nail varnishes were applied to all specimens from root apex to cementoenameljunction. Positive controls were obturated, but not coated with nail varnish. Negative controls were obturated and completely coated with nail polish, including the orifice. Samples were submerged in a vacuum flask containing Rhodamine-B dye, subjected to vacuum pressure of 75 torr for 30 minutes, and allowed to remain in the dye for seven days. Specimens were rinsed with water to remove the dye from the external surface and nail varnish was gently removed with scalpel. Then, these samples were sectioned longitudinally using a diamond disc and observed under a stereomicroscope at 10X magnification. The measurements were made by assessing the distance from the coronal extent to the greatest depth of dye penetration.

Results were tabulated and data was analysed using Analysis of Variance (ANOVA) and further pair wise comparison was performed by Bonferroni test. Level of significance was taken as 0.05.

RESULTS

Mean of group I(1.82 ± 0.7) was least followed by group II(2.3 ± 0.94) and then group III(2.19 ±0.85). There was statistically significant difference between group I and II and also between group II and III , as the P value was less than 0.05. There was highly statistical difference between group I and III with P value less than 0.001. Results are shown in table and graph.

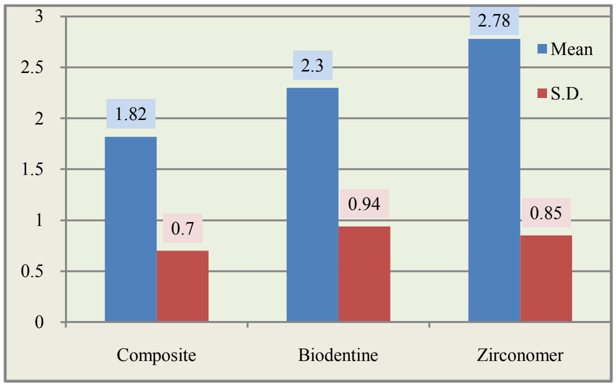

Table 1 Mean and standard deviation values of experimental groups

Group		Mean Difference	Standard error	'p' value and Significance
Composite	Biodentine	-0.487	0.001	0.005, significant
	Zirconomer	-0.3765	0.001	0.041, significant
Biodentine	Composite	0.487	0.001	0.005, significant
	Zirconomer	0.11	0.001	0.093, not significant
Zirconomer	Composite	0.376	0.001	0.041, significant
	Biodentine	-0.11	0.001	0.093, not significant

Table 2 Inter-Group comparison

DISCUSSION

For a successful endodontic treatment, an efficient seal to prevent leakage in the root canal system from both oral fluids & peri-radicular tissues is a prerequisite. Growing attention has been given to procedures carried out after completion of endodontic treatment as well as their impact on the prognosis of non-vital teeth.

In order to minimize the leakage potential, there is a constant search for the material and technique that ensures adhesion to the tooth structure. Microleakage is used as a measure by which clinicians and researchers can predict the performance of a restorative material.

The ideal properties of an intraorifice barrier suggested by Wolcott *et al.*[11] include the following characteristics: Easily placed, bonds to tooth structure, seals against microleakage, distinguishable from the natural tooth structure, and does not interfere with the final restoration.

Dye penetration method to check the microleakage is a simple, easier and cost effective method. This study used Rhodamine-B dye as it has small particle size, better penetration, water solubility, diffusability and hard tissue non-reactivity.[12]

The out-turnof this study shows that the positive control group leaked significantly more than the experimental group, emphasizing the fact that an effective barrier material can reduce microleakage inside the root canal. Various studies have been reported in literature regarding this certitude [13-15].

In this study, Bulk fill composite showed the least amount of leakage in comparison with the other two group. Bulk fill resin-based composite is used as a 4 mm bulk fill dentine replacement, which performs well with respect to marginal quality. The polymerization modulator present in these composite synergistically interacts with the camphoroquinone photo-initiator to result in a slower elasticity modulus development, allowing for stress reduction without a decrease in the rate of polymerization or degree of conversion. Similar results were shown by Patel *et al*[16] regarding significantly lesser microleakage seen in bulk fill composites as compared to nanohybrid ones.

Next to bulk fill, comes the biodentine with lower leakage as compared to zirconomer. Biodentine is a calcium silicate-based material. It bonds chemo-mechanically with the tooth along with the formation of tag like structures composed of Calcium or Phosphate rich crystalline deposits, which increases over time, hence minimizing the gap between tooth and Biodentine. This might be the reason for lower microleakage values. The results are in accordance with the study done by Solomon *et al*[17] and Kokate*et al*[18] demonstrating lesser leakage values of biodentine as compared to GIC.

Zirconomer, a new class of glass ionomer restorative material, exhibiting strength and durability of amalgam, along with bondable and fluoride releasing property of glass ionomercement . At the same time, it eliminates the hazardous property of amalgam because of mercury. Addition of zirconia as filler particle in the glass component of Zirconomer improves mechanical properties of the restoration by reinforcing structural integrity of the restoration in load bearing areas, where amalgam is the material of choice.

The imperfect sealing of the GIC linings might be explained by their hydrophilic properties, micro-gaps, and/or porosities. Micro-gaps are frequently detected in the restorations lined with GIC. Dentinal fluid might flow through incompletely sealed dentinal tubules to the interfacial gap. During setting, GIC absorbs a considerable amount of water, which may affect their sealing ability and other physical properties. Silica hydrogel forming around the glass particles is likely to act as a fluid reservoir. It also tends to undergo some amount of shrinkage during the setting, which can cause loss of the marginal integrity, thus leading to microleakage. Similar results were obtained by Kumar *et al*[19] and Pathak[20], showing higher values of leakage with GIC.

CONCLUSION

Within the limitations of this in-vitro study, it can be concluded that to reduce microleakage, a double seal is required, which could be achieved by placement of an intraorifice barrier. In the current study, bulk fill composite was found to be superior to biodentine and zirconomer. However, further long-term research may confirm better clinical results.

References

1. Parekh B, Irani RS, Sathe S, Hegde V. Intraorifice sealing ability of different materials in endodontically treated teeth: An *in vitro* study. *J Conserv Dent*.2014; 17(3):234-7.
2. Yavari H, Samiei M, Shahi S, Aghazadeh M, Jafari F, Abdolrahimi M, Asgary S.Microleakage Comparison of Four Dental Materials as Intra-Orifice Barriers in Endodontically Treated Teeth**.** *IranEndod J.* 2012;7(1):25–30.
3. Tselnik M, Baumgartner JC, Marshall JG. Bacterial leakage with mineral trioxide aggregate or a resin-modified glass ionomer used as a coronal barrier. *J Endod.* 2004;30(11):782–4.
4. Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *IntEndod J.* 1995;28(1):12–8.
5. Schwartz RS, Fransman R. Adhesive dentistry and endodontics: Materials, clinical strategies and procedures for restoration of access cavities: A review. *J Endod* 2005;31(3):151-65.
6. Ricucci D, Gröndahl K, Bergenholtz G. Periapical status of root-filled teeth exposed to the oral environment by loss of restoration or caries. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod*. 2000;90(3):354-9.
7. Aboobaker S, Nair BG, Gopal R, Jituri S,Veetil FR. Effect of Intra-Orifice Barriers on the Fracture Resistance of Endodontically Treated Teeth – An Ex-Vivo Study. *JClinDiagn Res*. 2015;9(2):17-20.
8. Roghanizad N, Jones JJ. Evaluation of coronal microleakage after endodontic treatment. *J Endod*.1996;22(9):471–3.
9. Carman JE, Wallace JA. An *in vitro* comparison of microleakage of restorative materials in the pulp chambers of human molar teeth. *J Endod.* 1994;20:571–5.
10. Bayram HM, Çelikten B, Bayram E, Bozkurt A. Fluid flow evaluation of coronal microleakageintraorifice barrier materials in endodontically treated teeth. *Eur J Dent.* 2013; 7(3): 359–362.
11. Wolcott JF, Hicks ML, Himel VT. Evaluation of pigmented intraorifice barriers in endodontically treated teeth. *J Endod*. 1999;25(9):589–92.
12. Wu MK, Wesselink PR. Endodontic leakage studies reconsidered. Part I. Methodology, application and relevance. *IntEndod J* 1993;26(1):37-43.
13. Khayat A, Lee SJ, Torabinejad M. Human saliva penetration of coronally unsealed obturated root canals. *J Endod* 1993;19(9):458-61.
14. Oliver CM, Abbott PV. Correlation between clinical success and apical dye penetration. *IntEndod J*.2001;34:637–44.
15. Yamauchi S, Shipper G, Buttke T, Yamauchi M, Trope M. Effect of orifice plugs on periapical inflammation in dogs. *J Endod*. 2006;32(6):524–6.

16. Patel P, Shah M, Agrawal N, Desai P, TailorK,Patel K. Comparative Evaluation of Microleakage of Class II Cavities Restored with Different Bulk Fill Composite Restorative Systems: An In Vitro Study. *J Res Adv Dent* 2016;5(2):52-62.
17. Solomon RV, Karunakar P, GrandhalaDS, ByragoniC. Sealing ability of a new calcium silicate based material as a dentin substitute in class II sandwich restorations: An in vitro study. *J Oral Res Rev* 2014;6(1):1-8.
18. Kokate SR, PawarAM. An in vitro comparative stereomicroscopic evaluation of marginal seal between MTA, glass inomer cement and biodentine as root end filling materials using 1% methylene blue as tracer. *Endodontology* (2012);24(12):36-42.
19. Kumar Y, Singh F, JindalN , Aggarwal R, Aggarwal K. An In-Vitro Comparative Evaluation Of Sealing Ability Of Resin Modified Glass Ionomer Cement, Mineral Trioxide Aggregate And Biodentine as A Furcation Repair Material: Analysis By Confocal Laser Microscopy. *IOSR Journal of Dental and Medical Sciences.*2016; 15(3): 26-30.
20. Pathak S. Comparative Evaluation of Sealing Ability of Root End Filling Materials: An In-Vitro Study. *Int J Dent Med Res.* 2015;1(5):48-52.

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