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Comparative evaluation of different restorative material used as intra orifice barrier in preventing coronal microleakage: An *in vitro* study

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Abstract
The aim of this *in vitro* study was to compare the efficacy of three different restorative material employed as intra orifice barrier after completion of endodontic treatment. Twenty extracted human maxillary and mandibular molars were divided randomly into four groups of five teeth each after completion of standard endodontic treatment. While the first group acted as positive control it was left unsealed coronally. In the rest of three groups, 3mm of Gutta-percha was seared from the canals and restored with one of the three restorative material acting as intra orifice barrier: Conventional GIC, Light cure (LC) GIC and flowable composite. The samples were then stored for 1 day and then immersed in (2%) methylene blue dye for 7 days. Teeth were longitudinally sectioned and examined under a stereomicroscope. The results showed that conventional GIC had the least mean dye penetration while highest dye penetration was observed in positive control group. Intra orifice barrier may be effective in preventing coronal micro leakage.

Keywords: Composite, coronal seal, intra orifice barrier and GIC

Introduction
Coronal leakage is considered significant factor for failure of endodontic treatment. The breach of seal in coronal segment of obturated root canal may significantly jeopardize endodontic treatment outcome [1-3]. Placing an additional protective barrier in the coronal portion of the root canal has been recommended to minimize microleakage and facilitate healing of apical periodontitis. Intra orifice barrier apart from enhancing probability of success of endodontic treatment may also augment periodontal therapy as intra pulpal infection is known to contribute in worsening of periodontal health by promoting marginal bone loss and pocket formation [4, 14].
Many materials have been tried as intra orifice barrier like cavit, IRM, amalgam, GIC, composite resin, dentin bonding agents, and MTA with conflicting result [15-29]. Recent studies have advocated use of adhesive restorative material like GIC to provide adequate seal against bacterial micro leakage. Glass ionomer may provide better seal against penetration of bacteria to the periapex because of its adhesive nature and ability to bond to the sclerotic dentin found on the pulpal floor better than composite resin.
As we know because of various anatomical communication (lateral canal, dentinal tubule) molars in general is more susceptible to the coronal contamination and active efforts are required to seal the array of communication that exists in it. Therefore this study is designed to check dye penetration and determine extent of coronal microleakage in molars. This *in vitro* study is designed to check the effectiveness of the intra orifice barrier in preventing coronal microleakage and also determine efficacy of materials: GIC, Dual cure GIC and Composite in preventing *in vitro* dye penetration in molars.

Materials and Methods
20 extracted human maxillary and mandibular molar (n= 60 root canals). Standard access cavity was made using round carbide bur and root canals instrumented up to size # 35/# 40 with step back technique. 5.25% Sodium hypochlorite was used as an irrigant. After drying the canals with paper points Cold lateral condensation technique was employed to obturate the

root canals using Zinc Oxide Eugenol sealer and Gutta-percha points (META BIOMED). Teeth were then randomly allocated to one of the following four groups.

Group 1 Positive control: access cavity was left unsealed.

Group II GIC

Group III LC GIC

Group IV Flowable Composite

Heated plugger was used to shear the Gutta-percha further 3mm from the orifice into the canal to create space for placement of one of the three restorative materials to act as intra orifice barrier in groups II, III and IV. Any residual sealer was removed with the cotton pellet moistened with the alcohol.

In group II GIC powder and liquid was mixed in the standard ratio of 3:1 on the paper pad with the plastic spatula applied in the orifice and condensed with the small round condenser. In group III light cure GIC (Fusion I seal, Prevest Den Pro) was directly applied inside the root canal with the help of Applicating tip and cured for 20s. In Group IV flowable composite (Pro Flow, SS WHITE, India) was used as an IOB according to manufacturer's instruction.

The teeth were stored for one day and then submerged in freshly prepared 2% methylene blue dye for seven days after coating them with the nail polish varnish on all surfaces only allowing dye to penetrate through coronal access. After 7 days teeth were taken out from the dye washed with the running water for 10 mins and was allowed to air dry for 24 hrs. Nail polish coat was then carefully removed with the scalpel and longitudinal section made with the diamond disc. Linear Dye penetration was measured from the Cementoenamel junction under the stereomicroscope (Radical Instruments, India) at 10 x power (Fig 1).

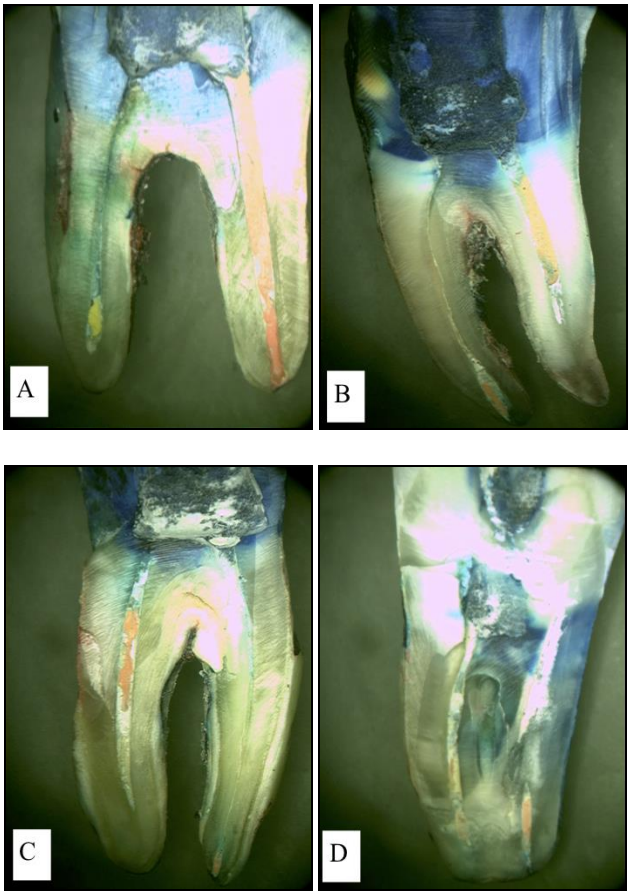

Fig 1: Stereomicroscopic image of specimen of each four groups control (A); GIC (B) LC GIC (C) Composite (D)

Result

Data were analyzed using SPSS software (IBM Inc, USA). Conventional GIC had the least mean dye penetration (1.71, SD = 0.19) whereas control group had the highest dye penetration (3.07, SD = 0.13). LC GIC and Composite had mean value of dye penetration of 2.15 (SD = 0.43) and 2.56 (SD = 0.69) (Table 1).

	1	2	3	4	Total
N	15	15	15	15	60
∑X	25.75	32.389	38.493	46.088	142.723
MEAN	1.71	2.15	2.566	3.07	2.37
$\sum X^2$	52.3153	110.14	199.34	145.45	507.25
VARIANCE	0.57	2.87	7.18	0.27	2.84
Std. Dev	0.76	1.69	2.68	0.52	1.68

The mean dye penetration of each group was compared using One Way ANOVA analysis (Table 2).

	Sum of square	Df	Mean square	F	Sig
Between group	15.037	3	5.012	1.837	0.151
Within group	152.766	56	2.728		
total	167.803	59			

Discussion

Dye penetration method though being destructive provides advantage of simple, easy and accurate instrument to check micro leakage [28-30]. The result of our study is in concurrence with the findings of Celik *et al*. showing that conventional GIC allowed less dye penetration than other two materials viz light cure GIC and Composite resin. Dentin bonding ability of GIC might be attributed to this finding although coronal seal of GIC has been found to vary in the literature and contradictory results has been reported [20, 23]. Presence of smear layer, contraction after setting and sensitivity to manipulation are the reasons highlighted in the text for decoration of its seal [29]. While the microleakage values attained by both light cure GIC and Composite were higher than conventional GIC it was still lower than the control group devoid of any intra orifice barrier. Inability of penetration of curing light at the depth 3mm inside the root canal added to the average length of crown of about 8-10 mm might be one of the reason. The bulk of cured mass in resin matrix significantly drops with less than 15% resin being polymerized from distance of more than 3mm.Decoronation performed in the past studies prior to the placement of the intra orifice barrier might explain better result obtained with the resin modified GIC and composite resin as it significantly reduces the distance between source of curing light and resin monomer [12, 25]. All the sample in control group allowed comparatively more dye penetration than the three group which had intra orifice barrier underlining the fact that Gutta-percha with sealer alone is ineffective to control coronal micro lekage [8, 9].

Conclusion

Within limitation of this study it can be concluded that conventional GIC may be a better alternative in providing coronal intra orifice seal as compared to LC GIC & Composite resin.

References

1. Saunders WP, Saunders EM. Coronal leakage as a cause of failure in root canal therapy: A review. Endod Dent Traumatol. 1994; 10:105-8.

2. Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of root filling and the coronal restoration. Int Endod J. 1995; 28:12-8.
3. Hommez GMG, Coppens CRM, De Moor RJG. Periapical health related to the quality of coronal restorations and root fillings. Int Endod J. 2002; 35:680-9.
4. Stassen IGK, Hommez GMG, Bruyn HDe, Moor RJGDe. The relation between apical periodontitis and root filled teeth in patients with periodontal treatment need. Int Endod J. 2006; 3:299-308.
5. Ng YL, Mann V, Rahbaran S, Lewsey J, Gulabivala K. Outcome of primary root canal treatment: systematic review of the literature-Part 2. Influence of clinical factors. Int Endod J. 2007; 40:1-26
6. Chailertvanitkul P, Saunders WP, Saunders EM, Mac Kenzie D. An evaluation of micro bial coronal leakage in the restored pulp chamber of root-canal treated multi rooted teeth. Int Endod J. 1997; 30:318-322.
7. Mavec JC, Minah GE, Blundell RE, McClanahan SB, Johnson JD. Effects of an intracanal glass ionomer barrier on coronal microleakage in teeth with post space. J Endod. 2006; 32:120-122.
8. Swanson K, Madison S. An evaluation of coronal microleakage in endodontically treated teeth. Part I. Time periods. J Endod. 1987; 13:56-9.
9. Torabinejad M, Ung B, Kettering JD. *In vitro* bacterial penetration of coronally unsealed endodontically treated teeth. J Endod. 1990; 16:566-9.
10. Khayat A, Lee SJ, Torabinejad M. Human saliva penetration of coronally unseale obturated root canals. J Endod. 1993; 19:458-61.
11. Mah T, Yared G, Friedman S. Periapical inflammation affecting coronally inoculated dog teeth with root fillings augmented by white MTA orifice plugs. J Endod. 2003; 29:442-446.
12. Jenkins S, Kulild J, Williams K, Lyons W, Lee C. Sealing ability of three materials in the orifice of root canal systems obturated with gutta-perch. J Endod. 2006; 32(3):225-7.
13. 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.
14. Jansson L, Ehnevid H, Lindskog S, Blomlof L. Relationship between periapical and periodontal status. A clinical retrospective study. J Clin Periodontol. 1993; 20:117-123.
15. Roghanizad N, Jones JJ. Evaluation of coronal microleakage after endodontic treatment. J Endod. 1996; 22:471-473.
16. Pisano DM, Di Fiore PM, McClanahan SB, Lautenschlager EP, Duncan JL. Intra orifice sealing of gutta-percha obturated root canals to prevent coronal microleakage. J Endod. 1998; 24:659-662.
17. Wolcott JF, Hicks ML, Himel VT. Evaluation of pigmented intra orifice barriers in endodontically treated teeth. J Endod. 1999; 25:589-592.
18. Wolanek GA, Loushine RJ, Weller RN, Kimbrough WF, Volkmann KR. *In vitro* bacterial penetration of endodontically treated teeth coronally sealed with a dentin-bonding agent. J Endod. 2001; 27:354-357.
19. Barthel CR, Zimmer S, Wussogk R, Roulet JF. Long-term bacterial leakage along obturated roots restored with temporary and adhesive fillings. J Endod. 2001; 27:559-562.
20. Beckham BM, Anderson RW, Morris CF. An evaluation of three materials as barriers to coronal microleakage in endodontically treated teeth. J Endod. 1993:19:388-91.
21. Wells JD, Pashley DH, Loushine RJ, Weller RN, Kimbrough WF, Pereira PN. Intra coronal sealing ability of two dental cements. J Endod. 2002; 28:443-447.
22. 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; 30:782-784.
23. Sauáia TS, Gomes BP, Pinheiro ET, Zaia AA, Ferraz CC, Souza-Filho FJ. Microleakage evaluation of intra orifice sealing materials in endodontically treated teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006; 102:242- 246.
24. Mohammadi Z, Khademi A. An evaluation of MTA cements as coronal barrier. Int Endod J, 2006; 1:106-108.
25. Ziang Q, Zhang Q, He J. An evaluation of intra orifice sealing materials for coronal microleakage in obturated root canals. Quintessence. 2009; 12:31-36,
26. Bailon-Sanchez ME, Gonzalez-Castillo S, Gonzalez-Rodriguez MP, Poyatos-Martinez R. Intra orifice sealing ability of different materials in endodontically treated teeth. Med Oral Patol Oral Cir Bucal. 2011; 16:105-109.
27. Lee KS, Kim JS, Lee DY, Kim RJY, Shin JH. *In vitro* microleakage of six different dental materials as intra orifice barriers in endodontically gtreated teeth. Dent Mater J. 2015; 34(4):425-431.
28. Uctasli MB, Tinaz AC. Microleakage of different types of temporary restorative materials used in endodontics. J Oral Sci. 2000; 42:63-7.
29. Uranga A, Blum JY, Esber S, Parahy E, Prado C. A comparative study of four coronal obturation materials in endodontic treatment. J Endod. 1999; 25:178-80.
30. Kazemi RB, Safavi KE, Spangberg LS. Assessment of marginal stability and permeability of an interim restorative endodontic material. Oral Surg Oral Med Oral Pathol. 1994; 78:788-96.