Tikrit Journal for Dental Sciences 1(2013)24-29

Microleakage of Root Canal Sealed with Temporary Endodontic Sealing Materials

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Key words
microleakage, glass ionomer cement, zinc phosphate, amalgam.

Abstract

To measure the microleakage of different materials used as temporary endodontic sealing materials and to compare between them. Sixty sound human premolars extracted for orthodontic purpose, caries and cracks free were used. Teeth were divided into 6 groups depending on type of temporary materials (glass ionomer cement, zinc phosphate cement, amalgam, temporary filling "zinc oxide eugenol") for temporization and control groups (negative and positive). For each tooth, an access opening was done followed by instrumentation, irrigation and dryness. Then application of different temporary materials. Evaluation of marginal microleakage (tooth – restoration interface) were done by using dye penetration test. The study was done in Department of Conservative Dentistry, College of Dentistry, University of Mosul. The results showed significant differences ($p< 0.05$) in marginal microleakage among groups tested. But there were no significant difference between buccal and lingual tooth restoration – interface for each group. Glass ionomer cement showed less microleakage at tooth – restoration interface when compared with other temporary filling materials which used in this study. Glass ionomer cement has superioer effect on reduction of microleakage when compared with other temporary filling,when used for temporization had more ability to reduce microleakage than zinc phosphate cement, amalgam and lastly temporary filling (zinc oxide eugenol).

Introduction

The aim of conservative dentistry always been maintain the health, function, form and esthetic of teeth [1]. Most pulpal and periapical diseases are a result of presence of bacteria within the tooth and particularly within the root canal system, therefore, the main principles of endodontic treatment should be aimed to eliminating all bacteria from the tooth and then attempted to maintain the tooth in this disinfected state by preventing any further ingress of bacteria during and after treatment [2,3] . So it is essential to minimize contamination of the root canal system due to microleakage between endodontic appointments and after the canal system has been obturated [4,5] . Temporary restoration is that term used to describe a restoration placed within an endodontic access cavity between appointments. A multitude of materials are used as temporary filling for endodontic access cavity preparation. Example: glass ionomer cement, cavit, amalgam, zinc phosphate and poly carboxylate cement and others. One of the most important factors determine the success or failure of root canal treatment is the use of temporary restorative material between appointments, these materials serve to seal

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temporarily, preventing the entry of fluids, microorganisms and other debris into the root canal space, also prevent the escape of medicaments into the oral cavity from pulp chamber [6,7] . So infection caused by the penetration of microorganisms into the tooth via the margins of the restoration has a greater threat to the pulp than the toxicity of restorative material itself [2,7]. A seal is defined as something that blocks entry into or out of container or other object, hence, it is a difficult term to justify or use clinically since complete sealing of a tooth is "impossible" with currently available dental materials and due to the porous nature of the tooth structure itself (especially dentine but also enamel) [2] . The aim of this study was to evaluate microleakage of different temporary materials used for temporization of endodontic cavity preparation and to compare between these materials to found the best material with less microleakage.

Materials and Methods

Sixty new extracted sound human premolars caries free, cracks free when examined with 4X magnifying glass. No sign of calcification with a fully formed apex. No attempted was made to identify patient age or sex. After extraction the teeth were stored for two days at room temperature in 3% NaCl for dissolution of organic debris [6,8]. Subsequently, they were scaled with ultrasonically and washed with distilled water for the removal of any calculus or soft tissue debris and they immersed in 10% formalin solution until use [9]. The study was conducted in Department of Conservative Dentistry, College of Dentistry, University of Mosul. The teeth were divided into 6 groups, 10 in each group depending on type of temporary materials used:

- Group 1: glass ionomer cement "Voco, Germany".
- Group 2: Zinc phosphate cement "Spofa Dental, Austeria ".
- Group 3: Amalgam "Viva Dent, Swiss".
- Group 4: Temporary filling (zinc oxide eugenol) "Digiana, Austeria ".
- Lastly: 10 permanent teeth for control +ve and 10 permanent teeth for control – ve group.

Access performed using a high speed rotary instrument turbine under water cooling with No. 4 round bur for initially entry and a diamond fissure bur to extend the preparation to desired occlusal outline [6] . One mm was subtracted from working length of the root canal, root canal preparation was preformed using conventional technique[10], the canals were irrigated using 5 ml of 5% sodium hypochlorite. Complete preparation of canal. The prepared access openings were air, dried and cotton pellets were placed on the pulp chamber, interappointment inter canal sealing materials occlude the canal orifice with at least 3 mm thickness [10,11] . In negative control, no restorative material was placed but the preparation were coated entirely with sticky wax, while positive control group had no restorative material and no sticky wax was applied [11,12]. In experimented groups, sealing of the apical foramen by using sticky wax distance at least 2mm. All experimented and control groups stored in container contain tap water at room temperature for at least 4 days, thermocycling for all groups about 500 cycles, temperature range between (5 – 55) °C. All groups except control positive group was subsequently coated with 2 layers of nail varnish, leaving an area of 1 to 2 mm around the filling uncoated [11,12] . Except for control negative, 2 layers of nail varnish coated along the teeth. All teeth immersed in methylen blue dye for (48) hours. After removal from the dye, the teeth rinsed under tap water for thirty minutes, then teeth were allowed to dry before cutting to prevent spreading of dye, the teeth were section by a diamond wheel the greatest depth of dye penetration was recorded [11,13]. For each restoration, on both the buccal and lingual tooth – restoration interfaces toward maximum penetration of dye using a binocular microscope and a calibrated eyepiece at X – 25 magnification in order to

measure the greatest depth of dye penetration [14] . Positive control section exhibit complete dye penetration where as negative controls has no dye penetration. All materials leaked at the interface material – dentine whereas some specimens absorbed the dye into the bulk of the materials [11]. Coronal marginal leakage was evaluated by measuring the linear penetration of the dye which was scored as shown in Figure (1) [11] :

-Score 1: dye penetration is over half of the pulp chamber .
-Score 2: dye penetration is within half of the pulp chamber .
-Score 3: dye penetration is within the dentine – enamel junction .

Results

Result of dye penetration include two reading for dye penetration which represent the microleakage where taken for buccal and lingual tooth – restoration interface (for each temporary material) [11]. The data were tabulated Table (1) and Table (2) according to the score. Statistical analysis by using Kruskal – Wallis Test for results of dye penetration for all groups indicated that significant difference in marginal microleakage among four groups ($p< 0.05$) as shown in Table (3). Glass ionomer cement showed less marginal microleakage followed by zinc phosphate cement, amalgam and lastly temporary filling (zinc oxide eugenol). Statistical analysis by using Mann – Whitney Test indicate that no significant difference between buccal and lingual tooth – restoration interface for all the experiment groups ($p\geq 0.05$) when compared together as shown in Table (4). Evaluation of marginal microleakage measured from margin of filling between tooth – restoration interface toward root canal apex as shown in Figures (2, 3,4 and 5).

Discussion

Microleakage is arguably the single most important risk factor for endodontic failure, closing the door on microleakage open the door to more predictable and successful endodontic outcomes, therefore, good coronal seal is one of the crucial factors in achieving success specially when permanent restoration is to be delayed [15, 16]. Bobotis *et al*.(1989) evaluated the sealing ability of cavit, cavit G, TERM, glass ionomer cement, zinc phosphate cement, polycarboxylate cement, and IRM, the results showed that glass ionomer cement, cavit, cavit G, TERM, zinc phosphate cement provided leak proof seals during the 8 weeks testing period, while leakage was observed in the 4 of the 10 teeth restored with IRM and polycarboxylate cement were the least effective of the materials test for preventing microleakage.[4] This is in agreement with our results were glass ionomer had more ability to reduce microleakage, this could be explained by the fact that glass ionomer had the ability to release fluoride which can help, protect tooth from further decay also glass ionomer restoration bond (stick) to the tooth structure which help to prevent leakage around the filling and further decay. Tulunogle *et al* [17] . Evaluated microleakage at the interface between various temporary restorative materials and existing amalgam or composite restoration, and dental tissues in previously restorated teeth after partial removal of the restoration. They concluded that CLIP provided a better seal against micoleakage at amalgam and especially composite interfaces. This material provided a better seal against microleakage at the tooth tissue – interface. Zemener *et al* [16] . Evaluated coronal microleakage of three temporary restorative materials an in vitro study using cavit, IRM and polycarboxylate cement. Result of study indicated that all materials leakage at the material – dentine interface, whereas some IRM specimens absorbed the dye into the bulk of the materials. In this study, there was no significant difference between buccal and lingual tooth – restoration interface for all the groups ($p\geq 0.05$). This fact related to the cavity position above the cemento – enamel junction and due to the orientation of the enamel rods and thickness of enamel [18].

Conclusions

1. Significant difference was found among materials used for temporization to reduce microleakage between tooth – restoration interface.
2. Glass ionomer had more ability to reduce microleakage then zinc phosphate cement, amalgam and temporary filling (zinc oxide eugenol).
3. No significant difference was found between buccal and lingual wall margins for all groups.
4. In general, temporary materials leakage at the interface "material – dentine", therefore, permanent restoration should be used instead of temporary materials.

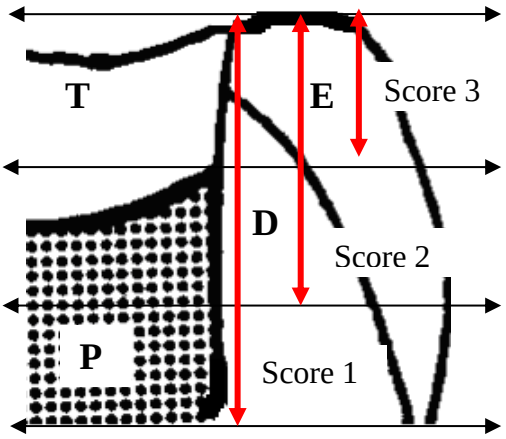

Fig. (1):- Grades of dye penetration [11].
E: enamel. D: dentine. P: pulp chamber.
T: temporary restoration.

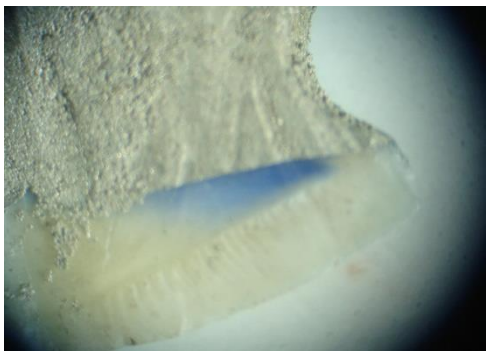

Fig.(2):- Figure shows microleakage at tooth - restoration interface when glass ionomer cement used as temporary filling.

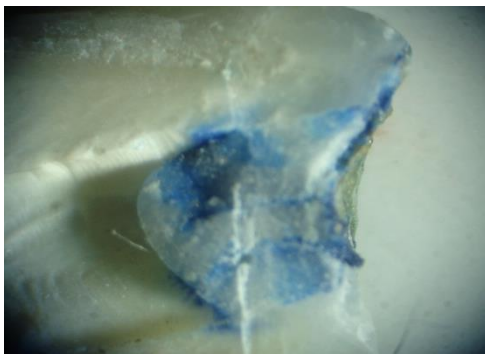

Fig.(3):- Figure shows microleakage at tooth - restoration interface when zinc phosphate used as temporary filling.

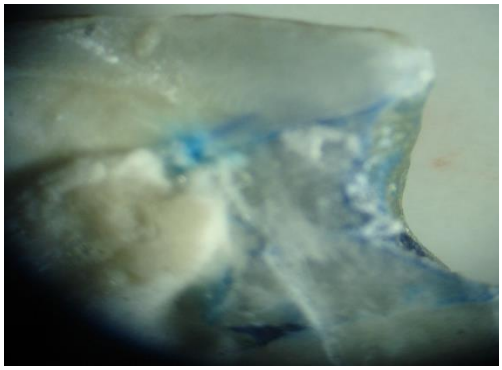

Fig.(4):- Figure shows microleakage at tooth - restoration interface when amalgam used as temporary filling.

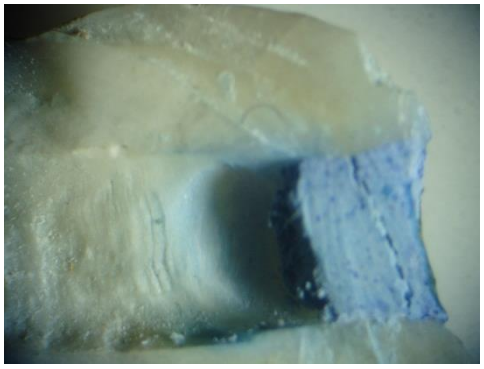

Fig.(5):- Figure shows microleakage at tooth - restoration interface when zinc oxide eugenol used as temporary filling.

Table (1):- Score of dye penetration for buccal wall.

Group	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	Median
Glass ionomer cement	3	2	3	3	3	3	2	3	3	3	3
Zinc phosphate cement	3	2	2	3	2	3	2	2	3	2	2
Amalgam	2	3	3	2	2	2	3	2	2	2	2
Temporary filling	1	1	1	2	2	1	1	1	2	2	1

Table (2):- Score of dye penetration for lingual wall.

Group	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	Median
Glass ionomer cement	2	3	3	3	2	2	3	3	3	2	3
Zinc phosphate cement	2	3	2	2	2	2	3	2	2	2	2
Amalgam	2	3	2	2	2	2	1	2	2	2	2
Temporary filling	2	1	1	2	2	1	1	2	1	1	1

Table (3):- Kruskal – Wallis test for comparing microleakage between the four groups.

Wall	Group	No.	Median	df	Test - value	P - value
Buccal	Glass ionomer cement	10	3	3	24.71	0.000
	Zinc phosphate cement	10	2			
	Amalgam	10	2			
	Temporary filling	10	1			
Lingual	Glass ionomer cement	10	3	3	19.50	0.000
	Zinc phosphate cement	10	2			
	Amalgam	10	2			
	Temporary filling	10	1			

Significant difference at $P< 0.05$

Table (4):- Mann – Whitney test for comparing microleakage between the buccal and lingual wall for four groups.

Group	Wall	No.	Median	Test - value	P - value
Glass ionomer cement	Buccal	10	3	115.0	0.366
	Lingual	10	3		
Zinc phosphate cement	Buccal	10	2	105.0	0.15
	Lingual	10	2		
Amalgam	Buccal	10	2	120.0	0.144
	Lingual	10	2		
Temporary filling	Buccal	10	1	119.0	0.103
	Lingual	10	1		

No significant difference at $P\geq 0.05$

References

1-Sturdevant CM. The art and science of operative dentistry. 3rd edition, Chapter 1, 3. 1994.

2-Jensen AL, Abbott PV, Castro SJ. Interm and temporary restoration of teeth during endodontic treatment, Aust Dent J. 2007; 52 (1 Suppl): 83 – 99.

3-Slutzky H, Weiss E, Matalon S. Antibacterial properties of temporary filling materials. J Endod. 2008 ; 32(3): 214 – 217.

4-Bobotis HG, Anderson RW, Pashly DH, Pantera EAJ. A microleakage study of temporary restorative materials used in endodontics. J Endod. 1989; 15(12): 569.

5-David M, Kenee DC, Captain SB. IRM an intrappointment endodontic sealing agent. J Endod. 2000; 22(8): 17 – 19.

6-Deveaux E, Hildebe P, Neut C. Bacterial microleakage cavit, IRM and TERM .Oral Surg Oral Med Oral Patho. 1992; 74(5): 634 – 643.

7-Verissimo DM, Sampiao M. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: a critical review. J Oral Sci. 2006; 48 (3): 93 – 98.

8-Al – Hezaimi K, Naghsh BJ, Oglesby S, Simon J, Rotstc I. Human saliva penetration of root canals obturated with two type of mineral trioxide aggregate cements. J Oral Endod. 2005; 31(6): 453 – 456.

9-Balas AS, Hicks ML, Barnett A. Comparison of laterally condensed tapered gutta percha and sealer: in vitro study. J Endod. 2006; 27(2): 786 – 788.

10-Dandakis C, Kaliva M, Lambrianidis T, Kosti E. An in vitro comparison of the sealing ability of three endodontic sealers used in canals with iatrogenic enlargement of apical constriction. J Endod. 2006; 31(3): 190 – 193.

11-Cruz EV, Shigetani K, Ishikawa K. A laboratory study of coronal microleakage using four temporary restorative materials. J Endod. 2008; 24: 53 – 58.

12-Uectas MB, Tinza C. Microleakage of different types of temporary restorative materials used in endodontics. J Oral Sci. 2000; 42: 63 – 67.

13-Holland R, Murata S, Babosa H. Apical seal of root canals with gutta points with calcium hydroxide. Braz Dent J. 2004; 5(1): 26 – 29.

14-Dandokis C, Kaliva M, Lambrianidi S. An in vitro comparison of the sealing ability of the three endosealers used in canals with iatrogenic enlargement of the apical consitriction. J Endod.2007; 31 (3): 319 -

15-Mitchell H, Davich DMD, Facal FD. Closing the door on microleakage. J Endod. 2007; 33 (3): 213 – 219.

16-Zemener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials – an in vitro study. J Endod. 2004; 30 (8): 582 – 584.

17-Tulunoglu O, Uctasli MB, Ozdemir S. Coronal microleakage of temporary restoration in previously restored teeth with amalgam and composite. Oper Dent. 2005; 30(3): 331 – 337.

18-Akiva S, Fusayama, Kahno J. Marginal closure of composite restoration with the gingival in cementum – dentin. J Prosth Dent. 1989; 61(3): 3 – 4.