ORIGINAL ARTICLE

Sealing ability of three temporary filling materials in endodontically-treated teeth

Mohammad Ghasem Aminozarbian[1] DDS, MS, Mahboobe Feizianfard[1*] DDS, MS, and Mahmood Karimi[2] DDS

1. Assistant Professor of Endodontics, Dental School, Isfahan University of Medical Sciences, Isfahan, Iran.
2. General Dentist.

Abstract

Introduction: Coronal microleakage may significantly reduce the prognosis of endodontic treatment. Temporary restorative materials have a crucial role in preventing the infection of root canals between and after endodontic treatment. This *in vitro* study was designed to evaluate the coronal microleakage of three temporary restorative materials used in endodontics: Coltosol, Cavisol and Cina.

Materials and Methods: Seventy-five human premolars and molars were selected for this *in vitro* study. Access cavities were prepared and amalgam placed on the orifices of canals; the occlusal surfaces were then reduced by 4mm for the temporary restoration. The teeth were divided into three experimental groups of 23 teeth and two control groups of 3 teeth. The access cavities in each group were sealed using one of the test materials and thermal cycling was applied (5-55ºC for 150 cycles). Surfaces were then covered with nail polish and wax; the teeth were immersed in 2% methylene blue dye for 7 days. The teeth were rinsed, dried, and sectioned mesiodistally and evaluated under a stereomicroscope for microleakage. Data was analyzed using Kruskal-Wallis and Mann U Whitney tests.

Results: The lowest microleakage value was observed in Cavisol and Coltosol groups and the highest in Cina group ($P<0.001$). There was no statistical difference between Cavisol and Coltosol.

Conclusion: Coltosol and Cavisol have appropriate sealing properties as temporary restorations, but the sealing ability of Cina was questionable. **[Iranian Endodontic Journal 2009;4(1):1-4]**

Keywords: Dental microleakage, Endodontics, Temporary dental restoration.

Received March 2008; accepted November 2008

*****Correspondence: Dr. Mahboobe Feizianfard, Department of Endodontics, Isfahan Dental School, Hezar Gerib Ave., Isfahan, Iran. E-mail: dr_m_feizianfard@yahoo.com

Introduction

Coronal microleakage can considerably affect the prognosis of endodontic treatment. An inadequate coronal seal will allow biologic contamination and penetration of saliva, nutrients, chemicals and importantly micro-organisms and their by-products. As a result endodontic failure may occur; coronal seal therefore can be regarded as important as the apical seal. Saliva is able to dissolve the sealer inside the canal and extensively contaminate the gutta-percha and periapex and ultimately develop pathologic lesions (1).

This could be prevented by using a temporary restoration with an acceptable seal against saliva, bacteria, their by-product and foods. Coronal seal is influenced by the restoration thickness, quality of condensation and total contact surface between intact tooth structure and the temporary restorative material. Minimum thickness of restoration on cavity edges should be 3-4 mm to tolerate the abrasion (2).

Microleakage can be evaluated by several methods including dye penetration, bacterial leakage, fluid filtration technique, electro-chemical conductivity, radioisotopes and SEM. Evaluation of dye penetration have been carried out *in vitro* with various conditions i.e. immersion time, thermo cycling and mastication pressure that may influence the results (3).

Different studies have been designed for evaluating of sealing ability of temporary restorative materials. Hagemeier *et al.* assessed the microleakage of five temporary restoratives including TERM, Ketac silver, IRM, Cavit and IRM-Cavit sandwich; TERM. Cavit, Cavit-IRM sandwich showed no microleakage, however Ketac silver and IRM displayed considerable microleakage (4). Asna Ashari *et al.* compared microleakage of four temporary restorations including Coltosol, Cavit, Citodor and Polycarboxilate using dye-penetration. Coltosol and Citodor showed the least and greatest microleakage, respectively (5). Zaia *et al.* evaluated the microleakage of four temporary restorative materials: Coltosol, IRM, Vidirion R and Scoth bond using dye penetration. All restorations showed dye penetration. IRM and Coltosol showed the best seal and Scothbond had the most microleakage (6). Zmener *et al.* evaluated the microleakage of IRM, Cavit and Ultratemp Firm. The specimens were placed in 2% methylene blue for dye penetration. All of them showed microleakage at the interface of restoration and dentin whilst IRM showed additional bulk microleakage (7). In the study of Balto *et al.* the microleakage of Cavit, IRM and Tempbond was evaluated. According to their study, Cavit had the least and Tempbond showed the most microleakage (8). Sauaia *et al.* evaluated the microleakage of Cavit, Vitremer and Flow-it and showed that all samples displayed dye penetration. Sealing ability of Cavit was significantly superior to the others; i.e. they prevented microleakage in 90% of specimens. Flow-it had the most microleakage (65% of specimens) but had no significant difference with Vitremer (55% of specimens) (9). As adequate coronal seal is important for the success of endodontic treatment the purpose of this study was to evaluate the sealing ability of three common temporary restorative materials; Cavisol, Coltosol and Cina.

Materials and Methods

Seventy-five extracted human maxillary and mandibular molars and premolars were selected for this experimental study. The teeth were caries free within the vicinity of the access cavity and were not previously root canal treated. The teeth were immersed in a 5.25% NaOCl for 5 minutes with the purpose of disinfection and removing soft tissue from the root surfaces. After cleaning, they were rinsed and stored in a normal saline solution. Standardized access cavities were prepared and then rinsed with 5.25% NaOCl for one minute. After drying the teeth, amalgam (Cinalloy, Tehran, Iran) was placed on the canal orifices so that the floor of access cavities became flat. After the amalgam set, the occlusal surface was reduced to obtain 4 mm depth in access cavity. A periodontal probe (Juya Instruments, Tehran, Iran) was used for measuring the final depth of cavity. The specimens were divided into five groups: three experimental groups with 23 teeth and two control groups of 3 teeth each. In the first group, Coltosol (Coltene, Altstatten, Switzerland) was placed incrementally in the access cavity according to the manufacturer's instructions. Cavisol (Golchay, Tehran, Iran) and Cina (Cina Bartar, Tehran, Iran) were used in the same manner in group 2 and group 3 respectively.

The three negative controls were filled by one of the temporary filling materials. The teeth for the positive controls were not filled with any restorative material.

Once the materials were set (2 minutes at room temperature), all experimental groups underwent thermocycling (5-55ºC 150 times). After the thermal shocks, all specimens were placed in normal saline and incubated for 24 hours for 37ºC in an incubator (Behdad, Tehran, Iran) for complete setting. The specimens were then dried. Afterwards, all surfaces (except occlusal) were coated with two layers of nail polish. All the samples were allowed to dry for one hour and then coated with inlay wax twice. Specimens were immersed in 2% methylene blue dye and incubated in 37ºC for seven days. Subsequently they were rinsed for 15 minutes and dried; the nail polish and inlay wax were removed by a scalpel and the teeth were then mounted in acrylic resin for sectioning.

The teeth were mesiodistally sectioned by a diamond disc (D & Z, Berlin, Germany). The sections were evaluated using a stereo-microscope (MGC, IO, Russia) with ×16 mag. using a digital camera (Motic Cam 480, Motic

Table 1. Bulk, marginal and overall microleakage in test groups

	Temporary filling material	Mean (mm)	SD	Min	Max	P-value
Bulk microleakage	Coltosol	1.43	0.85	0.47	3.99	0.118
	Cavisol	1.48	0.43	0.87	2.89	0.118
	Cina	2.43	0.64	1.29	3.94	0.000
Marginal microleakage	Coltosol	2.32	0.95	0.82	4.02	0.258
	Cavisol	2.06	0.69	0.65	3.43	0.258
	Cina	2.81	0.56	1.63	4.02	0.000
Overall microleakage	Coltosol	2.02	0.82	0.73	3.99	0.449
	Cavisol	1.87	0.51	0.84	3.02	0.449
	Cina	2.68	0.55	1.59	3.94	0.000

Instruments Inc., Canada) and dye penetration depth was assessed with 0.01 mm accuracy at the interface of restoration and dentin, as well as within temporary filling materials. The data was analyzed by Kruskal-Wallis and Mann U Whiney tests.

Results

The results of this study are illustrated in Table 1. Although the mean of marginal leakage in Cavisol (2.06±0.69 mm) was less than Coltosol (2.32±0.95 mm) and the mean of bulk leakage in Coltosol (1.43±0.85 mm) was less than Cavisol (1.48±0.43 mm); these differences however, were not statistically significant. The mean microleakage in Cina group was significantly higher than the other two.

Discussion

Assessing microleakage with methylene blue dye penetration is one of the most common methods utilized. This dye has high solubility in water, it can move by simple diffusion and it is not absorbed by the hydroxyapatite crystals of dentin (10). Recent studies evaluating microleakage used various dye penetrations, e.g. Zaia *et al.* used India ink, Tewari *et al.* and Zmener *et al.* used 2% methylene blue, Jenkins used India ink and Suehara *et al.* also used dye penetration in evaluating microleakage (6,7,11-13).

Parameters such as thickness of temporary restoration and thermocycling should be considered when making comparisons with other studies. Researchers have utilized a range of thicknesses to assess coronal seal. In Webber's study the least thickness used was 3.5 mm (14); Zaia *et al.* used 2 mm and Tewari *et al.* utilized 4-5 mm of temporary material (6,11). Balto used 3.5 and 3 mm thicknesses in two different studies (8,15). Deveaux *et al.* used 4.1 mm thickness (16,17). In our study we used materials with 4 mm thickness. Thermocycling also frequently increases microleakage within the margins of the restorative material (1). Deveaux *et al.* compared microleakage before and after thermocycling, they found that thermocycling had no significant effects on microleakage but it does affect the various temporary materials. IRM, for instance, was affected the most; hence the microleakage increased but Cavit was not affected at all (16,17). In our study, the thermocycling was used to create conditions similar to oral cavity.

Interestingly, our study showed that dye penetration values for Coltosol and Cavisol groups were almost similar and significantly less than Cina, concurring with Tabrizizadeh *et al.* and Barati *et al.* studies (10,18). Tabrizizadeh *et al.* compared the microleakage of Coltosol, Cavisol and ZOE using dye penetration. Their study showed that Coltosol had the least and ZOE had the most microleakage, but the difference between Coltosol and Cavisol leakage was not statistically significant (10). Barati *et al.* carried out a study to evalute the coronal seal of four temporary restoratives including Zonalin, Cavit, Coltosol and Cavisol using bacterial penetration. They showed that Zonalin had the most and Cavisol had the least sealability. There was no statistical significant difference between Zonalin and Cavit and between Cavisol and Coltosol (18). The excellent seal of

Coltosol has been demonstrated by several researchers. (5,6,10). This study was the first experiment that addressed the microleakage of Cina temporary material.

Conclusion

The marginal and bulk microleakage of Coltosol and Cavisol were similar and acceptable, however Cina had significantly greater microleakage. Coltosol and Cavisol produced a superior seal and were less affected by thermocycling and are suitable materials as temporaries for root canal therapies. The sealing ability of Cina was not adequate. Further studies are needed for considering other factors such as masticatory forces and comparing the results with/without thermo-cycling and with more than one week period.
Further studies are needed for considering other factors such as mastication force and comparing the results with/without thermo-cycling and with more than one week period.

Acknowledgement

This study was supported by the Research Center of Isfahan University of Medical Sciences (research proposal number 385305) and carried out at the Torabinejad Research Center of Isfahan University of Medical Sciences.

References

1. Gutmann JL, Witherspoon DE: Obturation of the Cleaned and Shaped Root Canal System. In: Cohen S, Burns RC: Pathways of the pulp, 8th Edition. St. Louis: CV Mosby, 2002: pp. 313-8.
2. Ingle JI, Simon JHS, Walton RE, Pashley DH, Bakland LK, Heithersay GS, In: Endodontics. 5th Edition. London. BC Decker, 2002:135.
3. Kirsty R. An "in vitro" study comparing the microleakage of four temporary sealing cements used in Endodontics. 1996, 33p Cited: www.//K:\kirsty.htm 2006/05/01.
4. Hagemeier MK, Cooley RL, Hicks JL. Microleakage of five temporary endodontic restorative materials. J Esthet Dent 1990;2:166-9.
5. Asna Ashari M. Body and marginal microleakage of 4 temporary filling materials in endodontic treatment. The Journal of Islamic Dental Association of Iran 1998;30:11-20.
6. Zaia AA, Nakagawa R, De Quadros I, Gomes BP, Ferraz CC, Teixeira FB, Souza-Filho FJ. An in vitro evaluation of four materials as barriers to coronal microleakage in root-filled teeth. Int Endod J 2002;35:729-34.
7. Zmener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials: an in vitro study. J Endod 2004;30:582-4.
8. Balto H, Al-Nazhan S, Al-Mansour K, Al-Otaibi M, Siddiqu Y. Microbial leakage of Cavit, IRM, and Temp Bond in post-prepared root canals using two methods of gutta-percha removal: an in vitro study. J Contemp Dent Pract 2005;6:53-61.
9. Sauáia TS, Gomes BP, Pinheiro ET, Zaia AA, Ferraz CC, Souza-Filho FJ. Microleakage evaluation of intraorifice sealing materials in endodontically treated teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;102:242-6.
10. Tabrizi Zadeh M, Aghajani A. An in vitro evaluation of microleakage of three temporary restorative materials used between endodontic appointments. The Journal of Islamic Dental Association of Iran 2002;40:5-14.
11. Tewari S, Tewari S. Assessment of coronal microleakage in intermediately restored endodontic access cavities. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002;93:716-9.
12. Suehara M, Suzuki S, Nakagawa K. Evaluation of wear and subsequent dye penetration of endodontic temporary restorative materials. Dent Mater J 2006;25:199-204.
13. 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-percha. J Endod 2006;32:225-7.
14. Webber RT, del Rio CE, Brady JM, Segall RO. Sealing quality of a temporary filling material. Oral Surg Oral Med Oral Pathol 1978;46:123-30.
15. Balto H. An assessment of microbial coronal leakage of temporary filling materials in endodontically treated teeth. J Endod 2002;28:762-4.
16. Deveaux E, Hildelbert P, Neut C, Boniface B, Romond C. Bacterial microleakage of Cavit, IRM, and TERM. Oral Surg Oral Med Oral Pathol 1992;74:634-43.
17. Deveaux E, Hildelbert P, Neut C, Romond C. Bacterial microleakage of Cavit, IRM, TERM, and Fermit: a 21-day in vitro study. J Endod 1999;25:653-9.
18. Barati M, Tabibian A, Kargar P. An in vitro evaluation of microleakage through four temporary restorative materials on mandibular premolars. DDS thesis. Dental School. Isfahan University of Medical Sciences. pp: 40-1.