SciMedCentral

JSM Dentistry

Research Article

In vitro Evaluation of Coronal Microleakage of Some Temporary Sealing Materials Used in Endodontic and Three Different Endodontic Sealers

Cláudia Tavares Machado Cunha*, Bruna Freire Salem de Miranda, Juliana Fernandes de Morais, Fabio Roberto Dametto, Arcelino Farias Netoand, Letícia Virgínia de Freitas Chaves

Department of Dentistry, Universidade Potiguar- LAUREATE-Unp, Brazil

***Corresponding author**

Cláudia Tavares Machado Cunha, Universidade Potiguar, Nesi nº2088, Bairro Nova Descoberta, Zip Code: 59056-490, NatalRN, Brasil; Tel: 55 (84) 99886681; Fax: 32151272; Email: ctmachadcunha@gmail.com

Submitted: 09 April 2014

Accepted: 15 April 2014

Published: 06 June 2014

ISSN: 2333-7133

Keywords

- Coronary infiltration
- Methylene blue
- Filling materials
- Temporary materials

Abstract

The aim of this study was to evaluate the microleakage of three temporary sealers (Bioplic®, IRM® and Restorative Glass of Ionomer Cement), and three endodontic sealers (Sealerpex, AH PLUS and Sealer 26). Thirty bovine teeth were stored in a solution of 0.1% thymol. All roots were cut 4 mm below the cementoenamel junction, and the exposed root canal was sealed with acrylic resin. The access to the pulp chamber was performed and the external surface was sealed with nail polish and Ethyl Cyanoacrylate. Those were distributed in 3 groups: G1 – Sealerplex filling material and Bioplic cap; G2 – AH PLUS filling material and IRM cap; G3 – Sealer 26 filling material and RGIC cap). The groups were stored at 37°C for 48 hours, thermocycled (125 cycles of 5° to 55°C), and dipped in aqueous solution of 2% methylene blue for 24 hours. Teeth were cleaned, cut longitudinally in the bucco-lingual direction and read with a digital caliper on both sides. The results were submitted to the Kruskal-Wallis test with a criterion, and Dunn's test at 5%. It can be concluded that the microleakage was higher in group 2 with no difference between groups 1 and 3.

INTRODUCTION

Coronal microleakage is a constant concern in dental practice in the specialties of endodontics, operative dentistry and prosthodontics. This problem is a potential factor in determining endodontic treatment failure [1] and can occur between endodontic sessions, before or after filling, if the tooth remain a long time without the definitive restoration [2].

Microleakage happens when a fluid passes from the oral cavity into the tooth via interface material/tissue [2]. Marginal leakage have been studied by several authors because it occurs around temporary sealing materials, in filled root canals, and coronal microleakage [2,3].

Teeth with root canal fillings should immediately receive definitive restauration, because coronal leakage can occur in a few days [4].

In order to prevent microleakage, temporary restorative material must seal hermetically the coronal chamber[4] and present favorable properties, such as marginal sealing, concomitant with antimicrobial power [5]. Additionally, it should be easy to handle, resistant to abrasion and compression, dimensionally stable, and prevent intracanal medication contact with the external environment [6].

Most provisional restorative materials have disadvantages, such as brittleness [5] , lack of adhesion [5], difficult removal [5], low resistance to compression and tension[5], high cost [4,5], time and labor [7], and, as main drawback, when in contact with oral fluids for long periods suffer solubility and disintegration [6]. These factors could compromise the endodontic treatment due to microorganisms seeping through the environment that was aseptic [7]. The literature still requires studies assessing if residual sealers left inside the pulp chamber could interfere on temporary sealings, leading to recontamination of the root canal system [7].

Therefore, the purpose of this study was to evaluate the marginal microleakage in different temporary restorative materials (IRM, RGIC, Bioplic), in bovine teeth roots as well as testing the endodontic sealers (Ah Plus, Sealer 26, and Sealerpex).

MATERIALS AND METHODS

Teeth obtainment

For this study thirty bovine teeth with similar root size were used. All teeth were cleaned under running water and kept in aqueous solution of 0.1% thymol until use [8].

Preparation of specimens

The roots were standardized; delimiting 4.0 mm below the cervical line (limit cementoenameljunction). The roots were cut with a diamond disk (KG Sorensen São Paulo Brazil) using low-speed hand piece. All teeth had their pulp chambers accessed giving a triangular shape, following the incisal base. This step was performed using a high speed turbine, under refrigeration, with a round drill 1015 (KG Sorensen, Brazil) to the point of choice and direction burr, and with a conical diamond tip with inactive end 3081 and 3082 (KG Sorensen Brazil), under refrigeration, to conform the contour shape and convenience.

Posteriorly, the specimens were sealed with two coats ofnail polish (*Risqué*®, São Paulo,SP, Brazil) and two layers of ethyl cyanoacrylate (*Super Bonder*® - Loctite - Henkel Ltda, São Paulo, São Paulo,SP, Brazil) across its outer surface, leaving a millimeter less than the edge of the access.

Division of groups and application of materials

The groups were divided according to Table 1.

The root canal was cleaned with 0.12% chlorhexidine and the sealer manipulation was done according to the manufacturer's instructions, using a spatula 24 (SSWHITE DuflexSão Paulo-SP). All root canals were filled with sealer and guttapercha cone (Dentsply). The material was spread around the pulp chamber walls leaving a layer 2 mm of filling material. After 15 minutes, the time required for the initial setting of this material, the temporary sealer was inserted, according to the manufacturer's directions of each group.

Microleakage test

All teeth were stored in plastic bags, with moist gauze, in stove at 37ºC for 48 hours, estimated time for complete set of all temporary sealing materials, followed by thermocycling (125 thermocycles between 5^0 and 55ºC, with a soaking time of 15 seconds). Subsequently, the specimens were immersed in 10 ml of 2% methylene blue for 24 hours, and dried afterwards. Following, they were sectioned in the buccolingual direction along the longitudinal axis of the tooth with a double-sided diamond disk (KG Sorensen Brasil) using a low speed hand piece.

Microleakage reading

Using a digital caliper (Digimess – Mitutoyo) on both sides of the same specimen, the leakage of a 2% methylene blue dye was analyzed. Subsequently, it was calculated the average of leakage for each specimen.

Statistical analysis

Descriptive statistical analysis was performed using IBM SPSS Statistic 20 software, and analytic statistical analysis was performed using Graphpad Prism V6.0 (α=5%).

Table 1: Division of groups and temporary restorative procedures.

Groups	Procedure
SE+GIC	Sealer 26 + RGIC cap
AH+IRM	Ah plus +IRM cap
SE+BIO	Sealerpex + Bioplic cap

Table 2: Statistician values to testing for microleakage.

Group	Difference in rank sum	Average	StandardDeviation*
SE+CIG	-14,45	0,37	0,43 [a]
AH+IRM	-0,8500	1,55	0,67 [b]
SE+BIO	13,60	0,28	0,19 [ac]

* Different letters represent a statistically significant difference (p<0.05).

RESULTS

Shapiro-Wilk test did not detect presence of normal distribution in one of the studied groups. Thus, the nonparametric Kruskal-Wallis test with a significance level of 5% was used for comparison among groups. The *p* value was 0.0002, showing a statistically significant difference between groups. The Dunn test was used for post-hoc test and evaluation of differences between the pairs of groups. There was statistically significant difference between SE+GIC and AH+IRM (p<0.05), and between AH+IRM and SE+BIO (p<0.05), but there was no statistically significant difference between SE+CIG and SE+BIO (p>0.05)

DISCUSSION

It was observed that the endodontic therapy is susceptible to microbial contamination by oral fluids during and after treatment of the canals [9]. When the same therapy is not held in one session, there is need to observe the properties of the temporary sealer, in order to avoid compromising the instrumentation and disinfection of the root canal.

Microleakage can be evaluated by different methods. The use of dyes are among the most common, such as the use of 2% methylene blue dye, which stains the tooth structure and interface tooth/restoration [10,11]. It supports the methodology used in this study which also used 2% methylene blue aiming to verify microleakage

Teeth sealing was performed with nail polish in order to prevent penetration of the dye by the tooth structure, as has been observed by other authors [11,12], respecting the limit of 2mm of the restoration margin [7,8,10].

Regarding the control group, the gutta-percha was the material of choice for not presenting satisfactory adherence to the dentinal tissue [8]. Thus, permitted the penetration of aqueous 2% methylene blue dye to identify the infiltration through the edges of the cavity. This marker substance which is used for *in vitro* verification has particles with sizes similar to bacterial products with known pathogenicity [11,12].

As regards the tested materials, most are based on a combination of zinc oxide and eugenol, which have been described in the literature with higher leakage rate [13-15] and confirmed by our results. In the present experiment, IRM had the worst performance when used as a temporary sealer independent of

the filling material, corroborating with the findings of Carvalho et al. [16], who compared both Bioplic and IRM and demonstrated that the IRM showed the worst results. These same authors [16] reported better sealing by Vidrion R compared to IRM, supporting our findings.

Our results showed microleakage in all studied materials, but with different behavior. Bioplic presented a similar performance to RGIC, and had a better outcome over IRM. These results disagree with other investigations [17,18].

Considering the limitations of an *in vitro* study, further clinical trials are needed to evaluate the microleakage of tooth/restoration interface, since all have their advantages and limitations. Other methodologies, such as a quantitative evaluation using the MEV and microbiological tests, should be employed to supplement the findings, since no method is ideal since they all have their advantages and limitations.

CONCLUSION

Based on the methodology used and the results obtained, it was concluded that the microleakage was higher using the canal filling materials AH plus and IRM.

REFERENCES

1. Zmener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials: an in vitro study. J Endod. 2004; 30: 582-584.
2. Zaia AA, Nakagawa R, De Quadros I, Gomes BP, Ferraz CC, Teixeira FB, et al. An in vitro evaluation of four materials as barriers to coronal microleakage in root-filled teeth. Int Endod J. 2002; 35: 729-734.
3. Pai SF, Yang SF, Sue WL, Chueh LH, Rivera EM. Microleakage between endodontic temporary restorative materials placed at different times. J Endod. 1999; 25: 453-456.
4. Cruz EV, Shigetani Y, Ishikawa K, Kota K, Iwaku M, Goodis HE. A laboratory study of coronal microleakage using four temporary restorative materials. Int Endod J. 2002; 35: 315-320.
5. Chohayeb AA, Bassiouny MA. Sealing ability of intermediate restoratives used in endodontics. J Endod. 1985; 11: 241-244.
6. Koagel SO, Mines P, Apicella M, Sweet M. In vitro study to compare the coronal microleakage of Tempit UltraF, Tempit, IRM, and Cavit by using the fluid transport model. J Endod. 2008; 34: 442-444.
7. Madarati A, Rekab MS, Watts DC, Qualtrough A. Time-dependence of coronal seal of temporary materials used in endodontics. Aust Endod J. 2008; 34: 89-93.
8. Seixas FH, Cecchin D, Filho AMC, Vansan LP, Silva RG, Pécora JD. Avaliação da microinfiltração coronária de três materiais utilizados na restauração provisória da cavidade endodôntica: Estudo in vitro. Revista Odontológica Brasileira Central. 2010; 19: 128-131.
9. Naoum HJ, Chandler NP. Temporization for endodontics. Int Endod J. 2002; 35: 964-978.
10. Cruz EV, Shigetani Y, Ishikawa K, Kota K, Iwaku M, Goodis HE. A laboratory study of coronal microleakage using four temporary restorative materials. Int Endod J. 2002; 35: 315-320.
11. Zmener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials: an in vitro study. J Endod. 2004; 30: 582-584.
12. Madarati A, Rekab MS, Watts DC, Qualtrough A. Time-dependence of coronal seal of temporary materials used in endodontics. Aust Endod J. 2008; 34: 89-93.
13. Lai YY, Pai L, Chen CP. Marginal leakage of different temporary restorations in standardized complex endodontic access preparations. J Endod. 2007; 33: 875-878.
14. Mayer T, Eickholz P. Microleakage of temporary restorations after thermocycling and mechanical loading. J Endod. 1997; 23: 320-322.
15. Zaia AA, Nakagawa R, De Quadros I, Gomes BP, Ferraz CC, Teixeira FB, et al. An in vitro evaluation of four materials as barriers to coronal microleakage in root-filled teeth. Int Endod J. 2002; 35: 729-734.
16. Carvalho MGP, Bier CA, Wolle CFB, Santos AID, Lopes AS, Montagner F. Avaliação in vitro da infiltração marginal do material selador temporário em dentes tratados endodonticamente. Revista Gaúcha de Odontologia, Porto Alegre. 2007; 53: 296-300.
17. Bitencourt PM, Britto MLB, Nabeshima CK. Avaliação do selamento de dois cimentos provisórios fotopolimerizáveis utilizados em endodontia. Revista Sul-brasileira de Odontologia (RSBO). 2010; 7: 269-274.
18. Gil AC, et al. Comparação da capacidade de selamento de três materiais restauradores provisórios. Revista UNINGÁ. Maringá. 2009; 1: 71-70.

Cite this article

Machado Cunha CT, de Miranda BFS, de Morais JF, Dametto FR, Netoand AF, et al. (2014) In vitro Evaluation of Coronal Microleakage of Some Temporary Sealing Materials Used in Endodontic and Three Different Endodontic Sealers. JSM Dent 2(3): 1031.