

EVALUATION OF THE MARGINAL LEAKAGE USING MODIFIED GLASS IONOMER RESIN AS TEMPORARY SEALER OF ENDODONTICS CAVITIES

Kalena de Melo Maranhão¹
Eliza Burlamaqui Klatau²
Suely Maria Santos Lamarão³

¹UFPA'S Dental School –
Belém-PA

²Assistant Professor,
UFPA'S Dental School –
Belém-PA

³Adjunct Professors,
UFPA'S Dental School –
Belém-PA

MARANHÃO, Kalena de Melo, KLAUTAU, Eliza Burlamaqui e LAMARÃO, Suely Maria Santos. *Evaluation of the marginal leakage using modified glass ionomer resin as temporary sealer of endodontics cavities. Salusvita*, Bauru, v. 28, n. 1, p. 31-39, 2009.

ABSTRACT

This study evaluates the marginal microleakage of resin modified glass ionomer – Vitremer/3M, used as temporary sealer after endodontic treatment. 36 molars were selected, in which, after endodontic treatment, cavities with 4mm of depth were standardized for the sealer material insertion, and divided into two groups of 18 teeth each: Group1 (conventional technique): primer + glass ionomer + protective of surface and Group2 (hybridization technique): 37% phosphoric acid + adhesive system Single Bond + glass ionomer + protective of surface. After restoration, all the specimens were thermocycled, impermeabilized and immersed in 2% of methylene blue solution for 7 days. After this period, the samples were washed in current water for 4 hours, sectioned mesiodistally and evaluated in stereomicroscope. The data were analyzed using Mann-Whitney Test at a significant level of 5%. The results revealed no statistically significant difference between the groups ($p > 0,05$) and that none of the tested groups were capable to completely eliminate marginal leakage. The authors concluded that the association of the adhesive

Recebido em: abril de 2007
Aceito em: january de 2008

system with a resin modified glass ionomer did not influence the sealing ability of those restorations.

Key words: Glass ionomer cement. Marginal leakage. Endodontic.

RESUMO

Este estudo avaliou a infiltração marginal do ionômero de vidro modificado por resina – Vitremer, utilizado como selador provisório após tratamento endodôntico. Foram selecionados 36 molares íntegros, nos quais, após o tratamento endodôntico, padronizou-se cavidades com 4mm de profundidade para inserção do material selador; originando dois grupos com 18 corpos-de-prova cada: Grupo 1 (técnica convencional) primer + ionômero + protetor de superfície e Grupo 2 (técnica com hibridização) ácido fosfórico 37% + adesivo dentinário Single Bond + ionômero + protetor de superfície. Procedeu-se então a termociclagem e em seguida a imersão em azul de metileno a 2% por 7 dias. Decorrido o prazo experimental os corpos-de-prova foram lavados em água corrente por 4 horas, seccionados longitudinalmente no sentido Mesio-Distal e levados à leitura em um esteromicroscópio. Os dados obtidos foram submetidos à análise estatística por meio do teste não paramétrico de Mann-Whitney com nível de significância de 5%, observando-se não haver diferença significativa entre os grupos ($p>0,05$) e que nenhum dos grupos testados foi capaz de impedir a microinfiltração marginal. Os autores concluem que a associação do sistema adesivo ao ionômero de vidro modificado por resina não influenciou no selamento das restaurações.

Palavras-chave: Cimento ionômero de vidro. Infiltração marginal. Endodontia.

INTRODUCTION

Studies have demonstrated that the coronal filling is as important as the apical, preventing the entry of fluids and microorganisms into the root canal space (HOMMEZ et al., 2002; SEGURA-EGEA et al., 2004).

The leakage is still considered as a factor in the failure of endodontic treatment. Thus, the search for an effective material has been a constant concern in the endodontics. In reality, a clean surface is essential for an effective sealing, therefore the presence of smear layer,

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

after the chemical-surgical preparation, can influence the coronal restoration sealing process. Thus, the united action of endodontic instruments and chemical substances during the biomechanical preparation provides the increase of the dentin permeability, due to the removal of smear layer, opening the dentinal tubules, providing the union between the material and tooth (STEWART et al., 1969; PAIVA; ANTONIAZZI, 1973; ÇOBANKARA et al., 2004).

Several temporary fillings are proposed to block the passage of fluids, microorganisms and substances in the interface between the restorative material and the dentin. Among the existent restorative materials, the glass ionomer cement, described in the 70's by Wilson and Kent offered various advantages such as chemically bonding to dental structure, thermal expansion coefficient similar to the tooth, antimicrobial activity and reduced microleakage (BUSSADORI; MUENCH, 1999; FORMOLO et al., 2001).

In the 80's, resin modified glass ionomer cement was formulated to overcome the moisture sensitivity problems of composites and the low mechanical strength of glass ionomers, while maintaining the clinical advantages of conventional glass ionomer cement (LIMA et al., 2002).

Different ways of restoring procedures have been proposed in the attempt of obtaining a good retention and consequently to reduce the marginal infiltration, among them the adhesive systems have been combined with the resin modified glass ionomers cements (NOVAES JR et al., 1998; SALLES et al., 1999; KRAMER et al., 2003).

Nowadays, despite all technological efforts, it was not possible to produce an adhesion system effective to bond restorative material with dentin.

The aim of this study was to evaluate in vitro the marginal leakage of the resin modified glass ionomer cement after root canal treatment comparing two different techniques: the conventional and with the hybridization technique.

MATERIAL AND METHOD

Thirty six caries-free extracted human maxillary and mandibular molar teeth were autoclaved and stored in distilled water. The Ethics Committee approved the study design. Access was made using a high speed air turbine under water coolant with a nº1014 round bur (KG Sorensen) for initial entry and an Endo-Z bur (Dentsply) to extend the preparation to the desired occlusal outline. The cervical third of the root canal was prepared with Gates Glidden drills (Dentsply),

Endo-PTC cream and 0,5% of sodium hypochlorite (Formula & Ação Farmácia), according to Paiva and Antoniazzi (1993).

A final irrigation with 30ml of 15% EDTA-T (Formula & Ação Farmácia) to remove the smear layer was made. The prepared opening was air-dried; cotton pellets and gutta-percha (G-C Chemical) were placed on the floor of the pulp chamber. The depth of the cavity was measured with a periodontal probe and allowed for at least 4 mm of temporary filling material (WEBBER et al., 1978).

The teeth were divided randomly into two groups of 18 teeth each. Group I-(conventional Technique): the primer was applied for 30 seconds using a microbrush and light cured for 20 seconds, with the apparel Curin Light XL 1500-3M, with potency of 550mw/cm². The resin modified glass ionomer cement was manipulated according to the manufacturer's instructions and inserted into the cavity using a syringe (Centrix Incorporated) and light cured for 40 seconds.

Group II-(hybridization Technique): the specimens were etched with 37% phosphoric acid for 15 seconds, washed for 10 seconds and dried with absorbent paper. A thin layer of adhesive system Single Bond (3M) was applied. The dentine bonding agent was light cured for 20 seconds. The material was prepared following the manufacturer's instructions. The resin modified glass ionomer cement was placed into the pulp chamber by a syringe (Centrix Incorporated) and light cured for 40 seconds.

In both groups the application and polymerization of the finishing-gloss were accomplished.

The sealers were stored in an incubator for 24 hours at 37°C and 100% humidity. Then the specimens were thermocycled at 500 cycles to temperatures of 5°C and 55°C, with 30 seconds of immersion in each bath.

The teeth were sealed with application of three super bonder layers, except over the coronal access. The teeth were then immersed in 2% methylene blue solution (pH 7,2) and stored in an incubator, maintained at 37°C for 7 days. The specimens were sectioned in a mesiodistal direction along their longitudinal axis with a low speed diamond cutter. After being sectioned, the samples were rinsed in tap water for 10 min to ensure removal of the debris and the smear layer created by the cutting.

The maximum linear coronal dye penetration was measured in millimeters, using a stereomicroscope (Technival Carl Zeiss) at a X25 magnification. One examiner, who had no knowledge of the treatment, analyzed the sections. The section that had the greatest depth of dye penetration was used as the final score for that specimen. The results were tabulated, and the mean value for each group was recorded.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

The obtained data were submitted to a statistical analysis using the Mann-Whitney test, with a significance level of 5%.

RESULTS

The results of the quantitative marginal analysis are presented in Figure 1, observing the comparison between the medium values obtained and the applied methods.

The Mann-Whitney nonparametric test showed no significant differences among groups ($p > 0,05$). However, the leakage values were significantly higher in the conventional technique than in the hybridization technique.

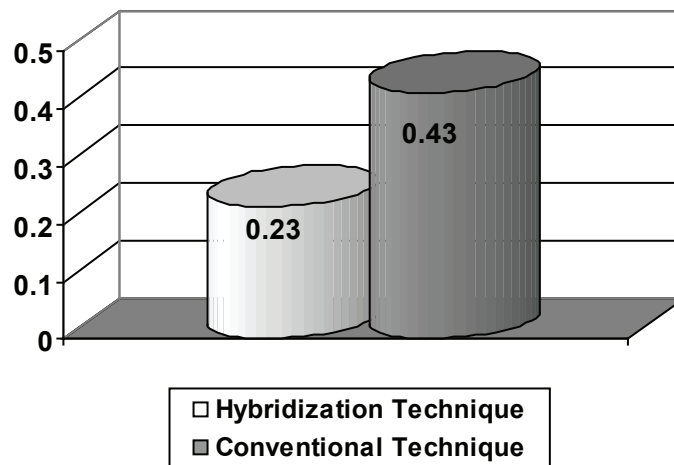


Figure 1 - Coronal leakage (mm) of the techniques tested

DISCUSSION

The resin modified glass ionomer cement has further created great interest for temporary restoration material, due to its advantages of fluoride release as well as the largest durability of the material, due to the resin incorporation, which provide a larger resistance to wear and fractures.

Thus, to keep the positive characteristics of resin modified glass ionomer cement, and also to improve bond strength, a combination with the adhesive system was developed.

The results of the present study showed leakage in different degrees among techniques, but it has no significant difference

between the groups ($p > 0,05$). Same results have been reported in previous studies (BUSSADORI; MUENCH, 1999; SALLES et al., 1999; LIMA et al., 2002; KRAMER et al., 2003) using similar methodology. In addition, Wang et al. (2006) also confirmed similar results while investigating the shear bond strength of resin-modified glass ionomer cements in human dentin using two adhesive systems.

However, Novaes Jr et al. (1998), Cacciafesta et al. (2003) and Wang et al. (2004) demonstrated that the modified technique showed better results than the conventional technique. Bernardo et al. (2000) have reported that the adhesion force for the acid conditioning technique is larger than the conventional technique.

Several studies have noticed the importance of the smear layer removal, to obtain better sealing ability of the restorative material. However, the results in this study didn't confirm these data, because the hybridization technique, that provide a larger removal of smear layer than the conventional technique, didn't improve the marginal sealing in endodontically treated teeth.

This result can be justified for the use of the irrigant solution during the endodontic therapy, which increases the dentin permeability. This is in accordance with other studies of the dentinal permeability that evidenced better results with the use of irrigant solution in biomechanical preparation. (NIKIFORUK; SREEBNY, 1953; PAIVA; ANTONIAZZI, 1973; ROBAZZA et al., 1981; VIVACQUA-GOMES et al., 2002; ÇOBANKARA et al., 2004)

Thus, was observed that the leakage in group I was not influenced by adhesive system, but by auxiliary substances that removed smear layer and prepared the dentin surface for better adhesion of the temporary restoring material. In relation to group II, the leakage is similar to group I, possibly originated from an inherent failure to the adhesive system (CARVALHO et al., 2004; WANG et al., 2006). In addition, Souza et al. (2005) confirmed similar results when liquid adhesives were applied at the pulp chamber walls, using similar methodology in this paper. Ozturk et al. (2004) also observed similar results, using the fluid filtration method.

Perdigão et al. (2000) and Uceda-Gomez et al. (2003) related that the residual NaOCl in the subsurface porous dentin could result in incomplete polymerization of resin monomers at the interface between the adhesive and dentin. Thus, these endodontic irrigants could interfere with the retention of the adhesive system.

Moreover, the results showed that none of the tested groups were capable to completely eliminate the marginal leakage in endodontically treated teeth.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

CONCLUSION

According to the methodology used, it was possible to conclude that none of the tested groups were capable to completely eliminate marginal leakage in endodontically treated teeth and the association of the adhesive system to resin modified glass ionomer did not influence the sealing ability of those restorations. Additional studies may be needed to verify the sealing quality provided by these techniques in clinical applications.

REFERENCES

- BERNARDO, P. C. et al. Avaliação clínica de um cimento de ionômero de vidro utilizado como selante oclusal. *Pesq Odont Brás*, v.14, p. 53-57, 2000.
- BUSSADORI, S. K.; MUENCH, A. Microinfiltração em dentes decíduos em função de materiais restauradores e condicionamento ácido. *Rev Odontol Univ São Paulo*, v.13, p. 369-373, 1999.
- CACCIAFESTA, V. et al. Use of a self-etching primer in combination with a resin-modified glass ionomer: Effect of water and saliva contamination on shear bond strength. *Am J Orthod Dentofacial Orthop*, v. 124, p. 420-6, 2003.
- CARVALHO, R. M. et al. Sistemas adesivos: Fundamentos para aplicação clínica. *Biodonto*, v. 2, p. 125-30, 2004.
- ÇOBANKARA, F. K. et al. Evaluation of the influence of smear layer on the apical and coronal sealing ability of two sealers. *J Endod*, v. 30, p. 406-409, 2004.
- FORMOLO, E. et al. Infiltração marginal em cavidades de classe V com o uso de diferentes materiais adesivos. *Rpg Rev Pos-Grad*, v. 8, p. 306-312, 2001.
- HOMMEZ, G. M. et al. Periapical health related to the quality of coronal restorations and root fillings. *Int Endod J*, v. 35, p. 680-89, 2002.
- KRAMER, P. F. et al. Microleakage between two filling restorative techniques using glass ionomer cement in primary molars: comparative “in vitro” study. *J Appl Oral Sci*, v. 11, p. 114-119, 2003.
- LIMA, D. R. et al. Avaliação do selamento de restaurações com cimento de ionômero de vidro resina-modificado em pregando como

pré-tratamento o ácido poliacrílico, ácido tânico e laser de ND:YAG. *PGRO-Pos-Grad Rev Odontol*, v. 5, p. 29-34, 2002.

NIKIFORUK, G.; SREEBNY, L. Demineralization of hand tissues by organic chelating agents at neutral pH. *J Dent Res*, v. 32, p. 859-67, 1953.

NOVAES JR, J. B. et al. Cimentos de ionômeros de vidro convencionais e modificados. Influência de adesivos e da umidade, sobre a adesão à dentina. *Rev FOB*, v. 66, p. 35-40, 1998.

OZTURK, B. et al. An in vitro comparison of adhesive systems to seal pulp pulp chamber walls. *Inter Endod J*, v. 37, p. 297-306, 2004.

PAIVA, J. G.; ANTONIAZZI, J. H. O uso de uma associação de peróxido de uréia e detergente (Tween 80) no preparo químico-mecânico dos canais radiculares. *Rev Assoc. Paul. Cir. Dent*, v. 27, n. 7, p. 416-422, 1973.

PAIVA, J. G.; ANTONIAZZI, J. H. Endodontia: Bases para a prática clínica. 2ª. ed. São Paulo: Artes Médicas; 1993.

PERDIGÃO, J. et al. Effect of a sodium hypochlorite gel on dentin bonding. *Dent Mater*, v. 16, p. 311-323, 2000.

ROBAZZA, C. R. C. et al. Variações na permeabilidade da dentina radicular quando do emprego de alguns fármacos auxiliares no preparo Endodontico. Contribuição ao estudo. *Rev Ass Paul Cirurg Dent*, v. 35, p. 528-533, 1981.

SEGURA-EGEA, J. I. et al. Periapical status and quality of root fillings and coronal restorations in an adult spanish population. *Int Endod J*, v. 37, n. 8, p. 525-30, 2004.

SALLES, V. et al. Avaliação in vitro da microinfiltração marginal de restaurações realizadas com um cimento de ionômero de vidro modificado por resina e uma resina composta modificada por poliácidos associadas a dois sistemas adesivos. *Rev FOB*, v. 7, p. 1-6, 1999.

SOUZA, F. D. et al. The effect on coronal leakage of liquid adhesive application over root fillings after smear layer removal with EDTA or Er:YAG laser. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, v. 99, p. 125-128, 2005.

STEWART, G. G. et al. EDTA and urea peroxide for root canal preparation. *JADA*, v. 78, p. 335-338, 1969.

UCEDA-GOMEZ, N. et al. Effect of sodium hypochlorite on the bond strength of an adhesive system to superficial and deep dentin. *J Appl Oral Sci*, v. 11, n. 3, p. 223-228, 2003.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

MARANHÃO,
Kalena de Melo,
KLAUTAU, Eliza
Burlamaqui e
LAMARÃO, Suely
Maria Santos.
*Evaluation of the
marginal leakage
using modified glass
ionomer resin as
temporary sealer of
endodontics cavities.*
Salusvita, Bauru,
v. 28, n. 1, p. 31-39,
2009.

VIVACQUA-GOMES, N. et al. Influence of irrigants on the coronal microleakage of laterally condensed gutta-percha root fillings. *Int Endod J*, v. 35, p. 791-795, 2002.

WANG, L. et al. Effect of one-bottle adhesive systems on the fluoride release of a resin-modified glass ionomer. *J Appl Oral Sci*, v. 12, p. 12-17, 2004.

WANG, L. et al. Effect of adhesive systems associated with resin-modified glass ionomer cements. *J Oral Rehabil*, v. 33, n. 2, p. 110-6, 2006.

WEBBER, R. T. et al. Sealing quality of a temporary filling material. *Oral Surgery*, v. 46, p. 123-30, 1978.

WILSON, A. D.; KENT, B.E. A new translucent cement for dentistry. The glass ionômero cement. *Brit Dent J*, v. 132, n. 4, p. 133-5, 1972.