INFLUENCE OF IRRIGANTS ON THE CORONAL SEALING ABILITY OF TWO SEALERS

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MARANHÃO, Kalena de Melo, KLAUTAU, Eliza Burlamaqui e LAMARÃO, Suely Maria Santos. *Ifluence os irrigants on the coronal sealing ability os two sealers*. *Salusvita*, Bauru, v. 27, n. 3, p. 363-370, 2008.

ABSTRACT

This in vitro study evaluated the coronal seal of two temporary coronal filling materials after root canal treatment. Standardized cavities accesses were prepared in 40 intact human permanent molar teeth. They were divided into two groups consisting of 20 samples. The teeth were restored using one of the following temporary filling materials, namely: Coltosol and Vitremer. After thermocycling, the specimens were covered with cyanoacrylate, except over the coronal access. The samples were immersed in 2% methylene blue dye solution for 7 and 30 days. The teeth were sectioned and the greatest depth of dye penetration was recorded. The results showed no significantly differences between the groups ($p>0,05$). Under the condition of this study, the irrigants solutions during root-canal treatment influenced coronal microleakage.

Key-words: Dental materials. Dental leakage. Endodontic.

Recebido em: fevereiro de 2008
Aceito em: maio de 2008

RESUMO

O presente estudo avaliou o selamento coronário de dois materiais restauradores utilizados como seladores provisórios após tratamento endodôntico. Foram selecionados 40 molares íntegros, nos quais, após o tratamento endodôntico, padronizou-se cavidades para inserção do material selador; originando dois grupos com 20 corpos-de-prova cada: Grupo I - Coltosol e Grupo II - Vitremer. Procedeu-se então a termociclagem e a impermeabilização dos espécimes, onde foi aplicado o cianocrilato em toda a superfície do dente, com exceção de 1 mm da interface dente/material. Logo após, metade de cada grupo foi imerso no corante azul de metileno a 2%, com pH 7,2, por 7 dias, enquanto que a outra metade permaneceu imerso na solução corante por 30 dias. Em seguida, os corpos-de-prova foram seccionados e levados à leitura. Os resultados demonstraram não haver diferença estatística significante entre os grupos experimentais nos períodos observados (p>0,05). Conclui-se que, a adaptação do material provisório às paredes dentinárias sofre influência da ação prévia do tratamento químico cirúrgico destas paredes.

Palavras-chave: Materiais dentários. Infiltração dentária. Endodontia.

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INTRODUCTION

When the coronal portion of the root canal is exposed to the oral environment, the obturated canal is a potent route for microorganisms to gain access to the periapical tissues (ADIB et al., 2004; SEGURA-EGEA et al., 2004; ZMENER et al., 2004; PAPPEN et al., 2005; SHIPPER et al., 2005; SIQUEIRA JR et al., 2005; WILLIAMSON et al., 2005). This situation may lead to endodontic failure. Therefore, the complete sealing of the endodontic access opening between appointments and after completion of therapy is an essential element in achieving endodontic success (ADIB et al., 2004; SEGURA-EGEA et al., 2004; SIQUEIRA JR et al., 2005)

A variety of temporary restorative materials have been tested in an attempt to provide a coronal barrier to prevent microleakage. Glass ionomers, mineral trioxide aggregate, cavit and IRM have all been tested as intracoronal barriers. Cavit is a premixed temporary filling material. They set on contact with moisture and possess hygroscopic properties (BALTO, 2002; ZMENER et al., 2004).

Resin-modified glass ionomers are a group of adhesive materials that combine some of the properties of glass ionomers with composite resin (GUPTA et al., 2002; PRABHAKAR et al., 2003).

Unfortunately, studies concerning the ability of this material to provide a seal in endodontic access cavities are rare. The purpose of this study was evaluate the sealing ability of a resin-modified glass ionomer material and to compare them with a popular temporary filling material (Coltosol), using the methylene blue dye penetration test.

MATERIALS AND METHOD

After approval of the project by the Research Ethics Committee of the Federal University of Pará (protocol 078/2005), forty caries-free extracted human maxillary and mandibular molar teeth were autoclaved and stored in distilled water. The Ethics Committee approved the study design. Coronal access to the pulp chamber was prepared by using #1014 (KG Sorensen) and Endo-Z (Dentsply) burs in a high-speed handpiece under copious water spray. The coronal half of the root canals was prepared with Gates Glidden drills (Dentsply), Endo-PTC cream and 15ml of 0,5% sodium hypochlorite (Formula & Ação Farmácia), using the method described by Paiva and Antoniazzi (1993).

A final irrigation of 15 ml EDTA-T at 15% (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 pulp chamber floor. A periodontal probe was used to measure the depth of the opening, assuring that it could accommodate at least 4 mm of the temporary filling material (WEBBER et al., 1978).

The teeth were divided randomly into two groups of 20 teeth each. Group I: Coltosol was introduced into the access opening with the use of an instrument. In Group II- Resin-modified glass ionomers (Vitremer-3M): the primer was applied by 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. The application and polymerization of the finishing-gloss were accomplished.

All the groups were stored in an incubator for 24 hours at 37ºC and 100% humidity. After setting of the materials, the specimens were thermocycled to 500 cycles, with temperatures of 5ºC and 55ºC.

The specimens were covered with Super Bonder, except over the coronal access and placed in 2% methylene blue solution (pH 7,2) and stored in an incubator maintained at a temperature of 37ºC for 7 and 30 days.

The specimens were sectioned in a mesiodistal direction along their longitudinal axis with a low speed diamond cutter. After 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.

T Student test was used to compare the groups for statistically significant differences at 5% significance level.

RESULTS

The mean microleakage values for the materials are listed in Table 1. Vitremer leakage less than Coltosol at 1 wk and 4 wk, but statistical analysis by T Student revealed no significant differences between the groups (p>0,05).

Table 1. Mean microleakage measurements (in mm)

GROUP		AVERAGE	STANDARD DEVIATION
I Coltosol	7 days	0,74mm	0,44mm
	30 days	1,44mm	0,22mm
II Vitremer	7 days	0,72mm	0,39mm
	30 days	1,41mm	0,32mm

DISCUSSION

The adhesive materials are widely used in restorative dentistry to improve the materials bonding and to prevent microleakage.

However, the results of this study indicated that a resin-modified glass ionomer material was not an effective barrier to prevent leakage in endodontically treated teeth. The results contradicts those obtained by Tselnik et al. (2004) who showed that this sealer provide an adequate barrier to microbial leakage. They concluded that this material possess many characteristics that may be desirable for a coronal barrier. First, they release and take up fluoride, being an antimicrobial agent. Next, requires minimal armamentarium. Finally, the material has demonstrated excellent sealing capabilities when placed on exposed dentin. Nevertheless, the tooth structure remaining, after endodontic therapy, may exhibit various altered physical characteristics because the application of irrigants solutions, which resulted in alteration of dentinal permeability (PAIVA; ANTONIAZZI, 1973; RALDI; LAGE-MARQUES, 2003; CARVALHO et al., 2005).

These solutions have been routinely used for many years as part of the chemomechanical preparation procedures in endodontic preparation for root canal cleansing and shaping. The application of EDTA chelates agents during endodontic therapy remove calcium ions from the coronal dentine walls (POLO, 2002) and demineralize the dentin (MIYASAKA; NAKABAYASHI, 2001; BOGRA; KASWAN, 2003; JACQUES; HEBLING, 2004), resulting larger dentinal tubule openings. Thus, this solution could interfere in retention of the resin-modified glass ionomer.

The presence of a rich organic collagen zone at the dentin surface has been shown to be important for a hybrid layer formation (NAKABAYASHI et al., 1982). Several researchers have studied the role of sodium hypochlorite (NaOCl) in dentin permeability and dentin adhesion. Uceda-Gomez et al. (2003) related that oxygen released by NaOCl molecules is another factor that may inhibit adhesive polymerization, interfering in the bonding interfaces. It has been also reported that the NaOCl removed collagen fibrils (PERDIGÃO et al., 2000; MARSHALL et al., 2001; CASTRO et al., 2004), leaving the dentin tubules region not completely filled, which could promote the degradation of the resin-modified glass ionomer.

Several authors have expressed some concerns about deficient or incomplete penetration of the resin monomers into the demineralized dentine. The deficit of resin in the demineralized area could result in a delicate zone inside the hybrid layer, susceptible to hydrolytic degradation (SANO et al., 1995; CARVALHO et al., 2004). A recent scanning electron microscopy study in endodontically treated teeth showed adhesive failures along the resin-dentin interfaces in intra-radicular dentin (CHERSONI et al., 2005). The authors observed

fluid droplets in bonded root treated dentin. Other studies also confirmed similar results when liquid adhesives were applied to pulp chamber walls. Ozturk et al. (2004) reported that no dental bonding systems had the ability to seal the pulp chamber. Souza et al. (2005) related that the Super Bonder was more efficient than the Single Bond adhesive.

In addition, the box shape of the cavity preparation may also interfere in the resin-modified glass ionomer adhesion due to polymerization shrinkage caused by the C-factor (cavity configuration factors) (OZTURK et al., 2004; CHERSONI et al., 2005).

CONCLUSION

According to the methodology used, it was possible conclude that the microleakage of the resin-modified glass ionomer in the present study can be attributed to the cavity configuration factors and incomplete sealing of bonding systems of coronal dentine surfaces. The permeability of other adhesives materials in endodontically treated teeth should be further examined.

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