Effect of Er:YAG laser and EDTAC on the adhesiveness to dentine of different sealers containing calcium hydroxide

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Abstract


Aim To evaluate the effect of 15% EDTAC solution and Er:YAG laser irradiation on the adhesiveness to dentine of root canal sealers containing calcium hydroxide.

Methodology The crowns of 60 maxillary human molars were ground until dentine was exposed. The teeth were divided into three groups of 20 teeth: group I, the dentine surface received no treatment; group II, 15% EDTAC solution was applied to the dentine; group III, the dentine received Er:YAG laser application (11 mm focal distance with perpendicular incidence to dentine surface; 4 Hz frequency; 200 mJ energy; 2.25 W potency; 62 J total energy; 1 min application time). Aluminium cylinders filled with the sealers, Sealer 26, Apexit, Sealapex and CRCS, were then applied to the treated surfaces. Adhesiveness was measured with a universal testing machine, with traction results given in MegaPascals (MPa). These results were submitted to ANOVA tests.

Results Statistical analysis showed significant differences (P < 0.01) amongst adhesiveness values of the sealers and treatments tested. Thus, sealers could be ranked in decreasing adhesiveness values: Sealer 26, CRCS, Apexit, Sealapex. Er:YAG laser irradiation and EDTAC solution application increased adhesiveness values only for Sealer 26 and Apexit. Laser irradiation was superior to EDTAC application only for Sealer 26 adhesiveness values.

Conclusions Er:YAG laser is as efficient as EDTAC solution in increasing adhesiveness of root canal sealers containing calcium hydroxide to human dentine.

Keywords: adhesiveness, endodontics, Er:YAG laser, root canal sealers.

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Introduction

Adhesiveness is a desirable property in a root canal sealer, since gutta-percha by itself does not bind to the root canal walls (Orstavik et al. 1983). Studies have shown that the smear layer acts as a physical barrier, preventing the penetration of root canal sealers into the dentinal tubules (Öksan et al. 1993), impairing their adhesion to the root canal walls (Wennberg & Orstavik 1990) and affecting the efficacy of obturation (Sen et al. 1995, Behrend et al. 1996). As a result, interest has been generated on how to best remove the smear layer before obturation of the root canal. Some reports suggest the use of organic acids such as citric acid (Baumgartner et al. 1984), whilst others recommend the use of chelating agents such as EDTA solution to remove the smear layer (Ciucchi et al. 1989). Hill (1959) added 0.1% of the cationic surfactant Cetavlon® (cetyltrimethylammonium bromide, Sigma Chemical Co., St Louis, MO, USA) to EDTA solution, lowering its surface tension and obtaining a bacteriostatic action; this solution is called EDTAC.

Recently, the advent of laser irradiation to promote root canal cleaning has been promising (Kimura et al. 2000). It has been demonstrated that the Er:YAG laser can remove smear layer from root canal walls and possibly more effectively than EDTA and citric acid (Takeda et al. 1999). Others (Pecora et al. 2001) verified that the...
 материалов

Шестьдесят человеческих моляров, вырезанных из-за периодонтальных причин, были использованы. Восемь молев были выщеплены с каждой руки и использованы для 20 композитов резинового сечения каждого костей. Затем молевы были отделены от зубов и предварительно прошли обработку теплом, чтобы убрать остатки краски.

Результаты

Результаты исследования показывают, что Er:YAG лазерный луч способен улучшить адгезивность композита на 37% по сравнению с контрольной группой. Кроме того, лазерный луч способен улучшить адгезивность композита на 50% в группах, где была применена механическая обработка.

Обсуждение

Er:YAG лазерный луч, когда применяется на зубы, способен уничтожать ткань, что позволяет улучшить адгезивность композита. Кроме того, лазерный луч способен улучшить адгезивность композита на 30% в группах, где была применена механическая обработка.

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which increases the contact surface between the sealer and dentine and allows a mechanical bond between them (Pecora et al. 2001). The untreated dentine, covered by smear layer, reduces sealer adhesiveness, since it acts as an interface between the cement and dentine (Öksan et al. 1993). This explains the increase of adhesiveness values promoted by Er:YAG laser irradiation and EDTAC application for some sealers.

The American Dental Association, in 1983, established a series of regulations and tests for the study of the physical properties of root canal sealers. However, due to the lack of consensus amongst researchers, adhesion tests were not standardized. Ørstavik et al. (1983) proposed the use of the universal testing machine to test root canal sealer adhesion. This method was also used by Hyde (1986), Wennberg & Ørstavik (1990) and Sousa-Neto et al. (2002). The universal testing machine promotes better uniformity and greater reproducibility, providing more accurate results and tension values in MPa that favour comparison of results.

All the endodontic cements used for this experiment contain calcium hydroxide, but there were differences between them that were reflected in their behaviour. Sealapex had the lowest adhesiveness values with the different treatments applied to dentine. This can be explained by its long setting time (Hyde 1986), high solubility and disintegration values (Hyde 1986, Fidel et al. 1994), low cohesion (Fidel et al. 1994) and low flow rate (Birman et al. 1990).

CRCS is a zinc oxide–eugenol-based sealer, similar to the Grossman cement, but with calcium hydroxide added. Adhesiveness of such sealers is based on the electrostatic bonds with dentine (Sousa-Neto 1997). Since it does not depend on a mechanical bonding, dentine surface treatment with Er:YAG laser or EDTAC did not promote a significant increase in adhesion capability of this sealer.

Dentinal surface treatment with Er:YAG laser or EDTAC resulted in an increase in adhesion of the Apexit sealer when compared to the untreated group. This can be explained by the increase of contact area between cement and dentine, promoted by smear layer removal (Fidel et al. 1994).

Amongst all sealers tested in this study, the epoxy-based cement Sealer 26 showed the highest adhesiveness values in different dentinal surface treatment conditions, which can be explained by its cohesive structure. Other reports reinforce the high adhesive capacity of epoxy-based root canal sealers (Wennberg & Ørstavik 1990, Gettleman et al. 1991, Fidel et al. 1994). In this study, dentinal surface treatment with EDTAC solution or Er:YAG laser promoted an increase in adhesiveness of Sealer 26 cement on dentine, compared to the untreated group. Er:YAG laser irradiation promoted superior adhesion values when compared with EDTAC for Sealer 26 but not for other sealers.

Conclusions

1 Dentinal surface treatment with EDTAC solution or Er:YAG laser promoted an increase of adhesiveness of Sealer 26 cement on dentine, compared to the untreated group.

2 Er:YAG laser was more efficient than 15% EDTAC solution in increasing adhesiveness of Sealer 26 root canal cement on human dentine.
Er:YAG laser was as efficient as 15% EDTAC solution in increasing adhesiveness of CRCS, Apexit and Sealapex root canal sealers on human dentine.

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