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Microleakage study of a restorative material *via* radioisotope methods

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ABSTRACT

Objectives: To validate the quantitative method used in the evaluation of microleakage and to evaluate the microleakage of dental restorations using GCP Fill. The null hypothesis was that the restorative system doesn't have any influence regarding microleakage.

Methods: Sixty noncarious extracted human molars were cut in two equal halves occlusogingivally and Class V cavities were prepared on the buccal or lingual surfaces of each tooth. The specimens were randomly divided into 4 groups. Two were restored with GCP Fill, while another was restored with Filtek Supreme. The control group was not restored. The specimens were stored in distilled water at 37 °C for 7 days before 500 cycles of thermocycling between 5 °C and 55 °C, dwell time of 30 s. The specimens were submersed in a solution of 99mTc-pertechnetate for 3 h and the radioactivity was determined. The nonparametric Kruskal–Wallis and Mann–Whitney test with Bonferroni correction at a significance level of 5% were used for statistical analyses.

Results: There were statistically significant differences between experimental groups and control groups ($p < 0.05$). Apart from these differences, a significant difference was observed between negative and positive control groups ($p < 0.001$). In the control + group there was a large microleakage, and the control-group received minimum counts.

Conclusion: The GCP Fill and the Filtek Supreme XTE do not differ as regards microleakage; this technique proved to be simple, quick and fulfilled the objective of a quantitative method in the evaluation of microleakage. Long-term clinical studies need to be carried out to substantiate these results.

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Estudo da microinfiltração de um material para restauração com recurso a métodos radioisótopos

Palavras-chave:
Microinfiltração
Cimentos de ionómero de vidro
Resinas compostas

RESUMO

Objetivos: Validar um método quantitativo de medição da microinfiltração e avaliar a microinfiltração de restaurações dentárias realizadas com GCP Fill. Considerou-se como hipótese nula que o material de restauração não tem influência na microinfiltração.

Métodos: Cortaram-se 60 molares humanos hígidos em duas partes iguais no sentido oclusogengival.e prepararam-se cavidades Classe V em cada metade. Os espécimes foram divididos aleatóriamente em 4 grupos. Em dois, foram restaurados com GCP Fill, noutro, com Filtek Supreme e no grupo controlo positivo não foram restaurados. Armazenaram-se os espécimes durante 7 dias em água destilada 37 °C antes de serem termociclados em 500 ciclos (5 °C e 55 °C, 30 segundos em cada imersão). Submergiram-se numa solução de 99mTc-Pertechnetate durante 3 horas e contou-se a radioatividade. A análise estatística realizou-se recorrendo aos testes não paramétricos Kruskal-Wallis e Mann-Whitney com correção de Bonferroni, considerando-se o intervalo de significância de 5%.

Resultados: existe diferença estatisticamente significativa entre os grupos de estudo e os grupos controlo ($p<0.05$). Existe diferença estatisticamente significativa entre o grupo controlo positivo e o grupo controlo negativo ($p<0.001$). A maior microinfiltração verificou-se no grupo controlo positivo enquanto que o grupo controlo negativo apresenta menores valores de contagens.

Conclusões: Não existem diferenças na microinfiltração entre as restaurações com GCP Fill e Filtek Supreme XTE; esta técnica provou ser simples e rápida e permite a avaliação quantitativa da microinfiltração. São necessários mais estudos clínicos para suportar os resultados deste trabalho.

Introduction

Nowadays the use of minimal invasive cavities and aesthetic fillings are possible due to improvements in the techniques of adhesive dentistry.[1] Composites and glass ionomer cements (GICs) have also been considerably improved in their aesthetic and mechanical properties.[1,2]

Composites fulfil a lot of basic requirements, such as aesthetics, good optical characteristics, wear resistance, and radiopacity; furthermore they are easy to handle and polish, tasteless, biocompatible and bondable to dental tissue.[3] However, some clinical and material limitations have restricted the universal use of composites as posterior restorative material.[4] When compared with GICs, they are more aesthetic and easy to polish and demonstrate better mechanical performances and surface integrity in the long term.[5–8] However, GICs have some advantages.[9,10] They allow marginal good sealing without microleakage,[7,11,12] are less susceptible to moisture than composites and the rubber dam can be dispensed with.[13–16] The use of these materials is reported with very few cases of postoperative sensitivity[7,17,18] and they can release fluorides inducing remineralization of the surrounding calcified dental tissues.[19–23] On the other hand some studies have demonstrated that GICs self-adhere to dental tissues, and this is also the case for resin modified glass ionomer cement (RMGIC), but this adhesion may be less effective than that obtained with a composite with adhesive systems.[23–28] Also, several studies have tested RMGICs bonded to dentine with a self-etch adhesive system and concluded that the association enhanced bond strength.[1,26,28] However, on analysing the systematic reviews of clinical trials there are some errors, which make some of these studies less reliable.[29]

Recently, a resin-modified glass-ionomer cement (RMGIC) was introduced in the market. GCP™ Fill (First Scientific Dental GmbH, Robert-Bosch-Strasse 26 D-25335 Elmshorn) incorporates fluoroaluminosilicate glass and polyacids, but has a different component embedded than the RMGICs, which is apatite.[30]

Microleakage is the clinically undetectable passage of bacteria, fluids, molecules and ions between the cavity wall and the restorative material[4,31,32] and is considered to be a major factor influencing the longevity of dental restorations.[4]

One of the objective methods for microleakage rating is the use of radioactive isotopes. Technetium is an artificial element, obtained by the radioactive decay of *molybdenum*, which is a radioactive metallic element belonging to the transition metals with an atomic radius of 135.8 pm. It is element 43 of the periodic table, and the radioactive element with the lowest atomic number. This presents a half-life of 2.6 h. Its decay occurs by isometric transition and emission of 140.5 keV of gamma radiation.[33]

The purpose of this study was to assess a quantitative method in the evaluation of microleakage and evaluate the microleakage of dental restorations using GCP Fill. The null hypothesis was that the type of restorative system does not have any influence regarding microleakage.