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Original research

Effect of ethanol solutions as post-polymerization treatment on the properties of acrylic reline resins

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ABSTRACT

Objectives: To evaluate the effect of ethanol solutions as post-polymerization treatment on the shear bond strength and the surface free energy of acrylic reline resins.
Methods: Three reline resins (Kooliner, Ufi Gel Hard and Probase Cold) were manipulated and attached to 150 parallelepipeds denture base resin previously aged. Constructed specimens of each resin were randomly divided into control group (left untreated) or experimental groups subjected to different treatments: immersion in water or ethanol solutions 20, 50 or 70% at 55 °C for 10 min ($n = 10$). Shear bond strength was tested and the failure mode was assessed. Surface free energy was calculated by determining the contact angle and estimated by the Wilhelmy plaque technique ($n = 5$). Data were analyzed using Kruskal–Wallis and Mann–Whitney tests with Bonferroni correction (alfa = 0.05).
Results: Probase Cold showed higher values ($p < 0.001$) in shear bond strength than other resins. There were no statistically significant differences ($p = 0.378$) in shear bond strength between post-polymerization treatments. Kooliner showed lower values ($p < 0.001$) in surface free energy than other resins. Considering the post-polymerization treatment groups, there were no statistically significant differences ($p > 0.05$) in surface energy.
Conclusions: Ethanol solutions as post-polymerization treatments did not deteriorate the bond strength of acrylic reline resins to denture base and neither their wettability.

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Efeito do tratamento pós-polimerização com soluções de etanol nas propriedades de resinas de rebasamento

Palavras-chave:
Etanol
Tratamentos pós-polimerização
Resistência ao corte
Energia de superfície
Resinas acrílicas

RESUMO

Objetivos: Avaliar o efeito do tratamento pós-polimerização com soluções de etanol na resistência adesiva a tensões de corte e na energia de superfície de resinas acrílicas de rebasamento.

Métodos: Cento e cinquenta paralelepípedos de resina de base protética, previamente envelhecidos, foram unidos a uma de 3 resinas de rebasamento (Kooliner, Ufi Gel Hard e Probase Cold). Os espécimes de cada resina foram aleatoriamente distribuídos por 5 grupos conforme o tratamento pós-polimerização: controlo (sem tratamento), imersão em água ou em soluções aquosas de etanol a 20, 50 ou 70% a 55 °C durante 10 minutos (n = 10). Foram realizados testes de resistência adesiva e o tipo de falha foi determinado. A energia de superfície foi calculada através da determinação dos ângulos de contacto pela técnica da placa de Wilhelmy (n = 5). Os resultados foram analisados com testes Kruskal–Wallis e Mann–Whitney com correção Bonferroni (alfa = 0,05).

Resultados: Os valores de resistência adesiva obtidos com Probase Cold foram estatisticamente superiores ($p < 0,001$) aos valores encontrados nas restantes resinas testadas. Não foram encontradas diferenças estatisticamente significativas ($p = 0,378$) entre os valores de resistência para os diferentes tratamentos realizados. Kooliner apresentou valores de energia de superfície estatisticamente inferiores ($p < 0,001$) aos das outras resinas. Entre os diferentes tratamentos pós-polimerização, não foram encontradas diferenças estatisticamente significativas ($p > 0,05$) de energia de superfície.

Conclusões: As soluções de etanol como tratamento pós-polimerização não afetam a adesão entre as resinas de rebasamento e a resina para base da prótese, nem a molhabilidade das mesmas.

Introduction

In clinical practice, removable prostheses may require periodic relining with autopolymerizing acrylic reline resins. It can be done in laboratory (indirect technique) or directly in mouth (direct technique).[1–5]

During the polymerization of the acrylic resins, the conversion of monomers to polymers is never complete and some unpolymerized monomers remain within the material.[6–9] These residual monomers can affect the mechanical and physical properties of the biomaterial or cause undesirable biological reactions when leached to the oral environment.[7,8] Post-polymerization treatments that decrease the residual monomer content have become relevant.[7] Recent studies showed that immersion of acrylic resins in water at high temperatures[8,10,11] or submitting it to microwave radiation[6,12–14] were effective treatments to reduce residual monomer. With the same goal, it has been proposed the immersion of polymeric materials in ethanol.[15,16] Since water immersion treatment is dependent on temperature,[11] promoting an additional polymerization of the resins and a decrease of residual monomer content,[7,12,17] possible benefits of the interaction between ethanol aqueous solutions and temperature have been suggested.[7]

Under experimental conditions, a post-polymerization treatment based on a combination approach of ethanol–water solutions and temperature (55 °C) for 10 min, enables the reduction of the monomer content and cytotoxicity of acrylic reline resins.[7] In this study, it was also showed that microhardness and flexural strength were not affected by the proposed treatments.[7] However, there are other surface properties that are crucial for adequate performance of dentures. The effect of these post-polymerization treatments on the bond strength between acrylic reline resins and denture base and the surface free energy of the reline resins has not been investigated.

Adequate bond strength between the denture base and reline resins is essential for successful clinical performance.[4,5,18] A weak bond can result in adhesive failure under low stress[4,5] that could result in debonding between the two materials and gap formation with ingress of bacteria and fungus and promote staining.[4,5,19,20]

Surface free energy strongly influences the wettability of relining materials which is one of the most important factor that influences the denture retention.[21] Also, along other surface properties such as hardness and roughness, surface free energy contributes to the adherence, bonding and colonization of fungal species.[22–26]

The purpose of this study was to evaluate the effect of post-polymerization treatment with several ethanol solutions on the shear bond strength (SBS) between acrylic reline resins and a denture base resin, and on the surface free energy of the reline resins, according to the following null hypotheses: (1) the acrylic reline resins used do not influence the SBS to

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