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College of Dentistry

The Impact of Calcium Carbonate Nanoparticles Incorporation into Heat Cured Soft Denture Lining Material on Thermal Conductivity and Some Other Properties

A thesis
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Abstract

Background: it is generally accepted that commercially available heat cured soft denture lining material are far from ideal due to low thermal conductivity, poor tear and bonding denture base with soft lining. Therefore, there is a need to improve such properties of soft lining materials.

Aim of the study: the reason of this study was to evaluate the impact of adding different percentage of calcium carbonate nanoparticles into acrylic based heat cured soft denture lining material on thermal conductivity, thermal diffusivity, radiopacity, and a few of mechanical properties including tensile bond strength, tear strength, hardness and surface roughness.

Materials and methods: calcium carbonate nanoparticles ($CaCO_3$NPs) with concentration of 0%, 1.5% and 2% by weight were incorporated into the soft liner material. Firstly, $CaCO_3$NPs was dispersed into the monomer of the soft liner by using probe sonication apparatus and then measured amount of the soft liner' powder blended into this suspension. One hundred and eighty specimens were prepared which were divided into six groups according to the tests to be performed. Each group consist of thirty specimens (10: control, 10: with 1.5% calcium carbonate nanoparticles and 10 with 2% calcium carbonate nanoparticles addition).

Scanning electron microscope was used to show the dispersion of calcium carbonate nanoparticles within polyethylmethacrylate (PEMA) soft liner matrix and energy dispersive x-ray spectroscopy analysis was performed to show the percentage of composite filler of both weight and atoms.

Moreover, some of the physical and mechanical properties of the $CaCO_3$NPs/soft liner composite were investigated including thermal conductivity, thermal diffusivity, tensile bond strength, tear strength, radiopacity, shore A hardness and surface roughness.

Results: addition of 1.5% and 2% of $CaCO_3$NPs into PEMA soft liner showed a highly significant increase of thermal conductivity, thermal diffusivity, tensile bond strength, tear strength and radiopacity. Shore A hardness registered a highly significant increase; yet, the results for surface roughness observed a non-significant change.

Conclusion: the addition of $CaCO_3$NPs into heat cured acrylic-based soft denture liner material could improve thermal conductivity, thermal diffusivity, tensile bond strength, tear strength, radiopacity properties, although surface roughness is not affected as the concentration of nanoparticles increase. Yet, the hardness was highly significant increased.

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تأثير كربونات الكالسيوم النانوية المدمجة في مادة التبطين اللينة المعالجة حرارياً على الموصلية الحرارية وبعض الخصائص الأخرى

رسالة

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من قبل

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