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Effect of silica filler on properties of PMMA resin

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Purpose: Of this paper was to investigate the effect of silica nanofiller addition to PMMA-based denture material. The null hypothesis was that no difference exists between the mean flexural strength, hardness, sorption among materials without and with different content of silica filler.

Design/methodology/approach: The nanosilica was introduced into "powder" component of commercially available PMMA resin for dentistry in concentrations 2, 5 and 10%. The SEM observations were made to confirm dispersion quality. To confirm presence of silica filler the X-ray microanalysis have been made. The influence of nanosilica addition on flexural strength, flexural modulus, hardness and sorption were investigated. Samples were stored at distilled water and ethanol solution. Statistical analysis were prepared with the one-way or the two-way analysis of variance ANOVA ($\alpha=0.05$), and Newman-Keuls significant difference post hoc test was used to determine the differences between mean values ($\alpha=0.05$).

Findings: The result show that all investigated properties were changed after silica filler addition. Initially flexural strength decreased, but after accelerated again in ethanol incised. Flexural modulus and hardness increased. Sorption was decreased in both aging liquids.

Research limitations/implications: Limitations resulting from the specificity of the conditions of laboratory tests and aging conditions so it does not allow to fully translate obtained results to expected results of clinical trials.

Practical implications: The PMMA drawback is still insufficient mechanical properties, so it can be easily damaged during an accidents or when a patients applies high mastication force to the denture which show areas for further mechanical properties improvement. One of the ways of improving the mechanical properties of PMMA based materials may be nanoparticle addition, including commonly used nanosilica fillers.

Originality/value: Influence of destructive plasticizing solutions on chosen properties of materials with different concentrations of silica fillers have been investigated.

Keywords: PMMA; Denture; Silica filler; Aging; Flexural strength; Hardness; Sorption

Reference to this paper should be given in the following way:

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