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The Effect of Polyester Fibers Addition on Some Mechanical Properties of Room Temperature Vulcanized Maxillofacial Silicone Elastomers

A thesis

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Abstract

Background: Silicone elastomer became material of choice for construction of maxillofacial appliance because of their advantageous properties like ease of manipulation, chemical and biological inertness, ease of coloration, good mechanical properties when compared to other material. Silicone elastomers are still far away from ideal and suffer from many problems such as poor tear strength, discoloration and degradation when exposed to daily environmental factors for long time that necessities their replacement. However many research has been directed toward improvement of silicone properties.

Aim of study: The aim of this study was to evaluate the effect of addition (0.25% and 0.5%) by weight concentration of (0.017mm) in diameter of (2mm length) polyester fibers on some mechanical properties as tensile strength and percentage elongation, tear strength, Shore A hardness and surface roughness of commercial room temperature vulcanized platinum A-2186 silicon elastomers used in maxillofacial prosthesis fabrication.

Material and method: One hundred twenty samples were prepared and divided into 4 groups; each group contained 30 samples for each conducted test (tensile strength test. tear strength test, shore A hardness test and surface roughness test). The thirty samples of each test were subdivided into 10 samples for control groups (without addition of polyester fibers), 10 samples of 0.25%by weight polyester fiber/silicone group and 10 samples of 0.5% by weight polyester fibers/silicone group. Measurement of tear and tensile tests were examined by universal testing machine. Surface roughness test was examined by digital profilometer and hardness test was tested by Shore A Durometer. Three samples (0%, 0.25% and 0.5%) by weight of polyester

fibers are examined under scanning electron microscope (SEM) to evaluate polyester fiber distribution and orientation then the same samples examined by XRD and FTIR test to evaluate polyester fiber bonding and interaction with silicone elastomeric matrix. Data from measurement are collected and statistically analyzed using one way ANOVA and LSD analysis.

Results: The measurements showed non-significant increase of tensile strength of the silicone after addition of polyester fibers at (0.25%) by weight concentration and decrease at (0.5%) by weight of polyester fibers. The results of percentage elongation showed non-significant increase with increased polyester fibers concentration. The results of tear strength showed increased values at 0.25% by weight of polyester fibers when compared to control group while decreased when polyester fiber concentration increased to 0.5% by weight. The surface hardness and roughness results showed proportional increase with increased polyester fibers concentration. FTIR test indicate some degree of combination between polyester fibers and silicone elastomeric matrix at some band frequencies. XRD test showed change in silicone lattice network by polyester fibers especially at 0.5% by weight polyester fibers concentration. SEM test showed random distribution of polyester fibers without aggregation.

Conclusion: Reinforcement of A-2186 RTV silicone with (0.25%) by weight concentration of polyester fiber causes non-significant improvement of (tensile strength, tear strength and percentage elongation). Further increase of polyester fibers concentration causes deterioration of material mechanical properties.