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**The Effect of Aluminum Oxide Nanoparticles on Some
Mechanical Properties of Room Temperature Vulcanized
Maxillofacial Silicone After Artificial Aging**

A Thesis

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Abstract

Background: The facial prostheses made to restore a missing part of the face, so it must be made from a material that mimic the surrounded soft tissues and skin in properties. The studies nowadays showed that the maxillofacial silicone elastomer is widely used for this purpose because of its biocompatibility, can be easily colored by intrinsic or extrinsic coloration and good elasticity. The drop points of the pure silicone elastomers are the mechanical properties as the tear strength and the tensile strength, which need to be improved to be clinically applicable. This improvement may be done by the addition of some types of Nano-oxide fillers.

Aim of the study: The aim of this study was to evaluate the effect of the addition of Aluminum oxide (Al_2O_3) Nano fillers on some mechanical properties of VST 50F room temperature vulcanized maxillofacial silicone before and after (100 hours) of the artificial accelerated aging.

Materials and methods: The pilot study was done to select the proper addition concentration in the main study, some mechanical properties of VST 50F silicone were tested with the addition of 0.5%, 1%, 1.5% and 2% concentrations of Aluminum oxide Nano-fillers, and found that these properties could improve with the addition of 1% and 1.5% concentration of the Nano-fillers, so these concentrations were selected to be added in the main study. In the main study, two main groups were prepared one before artificial accelerated aging and the other after 100 hours of artificial accelerated aging, in each group, a one hundred twenty samples were fabricated, 40 samples for each reinforcement concentration (1% and 1.5%) and 40 samples for 0% (control group), which were subdivided into four subgroups, each subgroup involved 10 samples for each test (tear strength, shore A hardness, surface roughness and tensile strength). The mixing and curing of the maxillofacial silicone elastomer was performed following the manufacturer

instructions, the main study results were analyzed statistically by one-way ANOVA (analysis of variance) and the post hoc tests. The Fourier Transform Infrared Spectroscopy Analysis (FTIR) and Scanning Electron Microscope (SEM) tests were done for the control sample and for the samples of 1% and 1.5% Al₂O₃ Nano-fillers incorporation.

Results: Before artificial aging, there were a highly significant increase in tear strength, tensile strength, shore A hardness and surface roughness, while the elongation percentage was significantly decreased for 1% and 1.5% groups compared to the control group. After the artificial aging, there was a slight decrease in tear strength and tensile strength, while for the hardness there was a highly significant increase and for the surface roughness, there was a non-significant increase, all these results were directly proportional with the increased concentration of Nano-filler addition from 1% to 1.5%. Finally, for the elongation percentage there was a slight decrease for 1% group followed by a slight increase for 1.5% group.

Conclusion: The addition of Aluminum oxide Nano-fillers to the VST 50F RTV maxillofacial silicone improved some of the mechanical properties of silicone. The artificial accelerated aging for 100 hours cause a deterioration in the mechanical properties of the maxillofacial silicone reinforced with Aluminum oxide Nano-fillers.