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Analysing the effect of addition of silica nanoparticles on mechanical properties of dental stone and die stone: An in-vitro study

Running title: Effect of silica nanoparticles on mechanical properties of dental stone and die stone.

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Abstract

Aim: This in-vitro study was performed to compare the surface roughness, diametral tensile strength (DTS), and compressive strength of dental stone and die stone before and after the addition of 5wt% silica nanoparticles.

Material and Methods: A total of 120 specimens were prepared, 60 for each dental stone and die stone. For the test groups, 5wt% silica nanoparticle was added. Surface roughness was measured using TR200 while DTS and compressive strength were measured using the Universal testing machine. The intergroup comparison was done using the independent t-test.

Results: The mean surface roughness of dental stone and die stone in the control group was 3.16µm and 2.96µm respectively and in the test group was 2.88µm and 2.53µm respectively. The mean DTS of dental stone and die stone in the control group was 1.29 MPa and 1.51 MPa respectively, while that in the test group was 1.01 MPa and 1.14 MPa respectively. The mean compressive strength of dental stone and die stone in the control group was 14.02 MPa and 16.25 MPa respectively and in the test group was 10.38 MPa and 11.28 MPa respectively.

Conclusion: Surface roughness was statistically lower for dental stone (p=0.018) and die stone (p=0.0018) when 5wt% silica nanoparticles were added. There was a statistically significant reduction in the DTS after the addition of silica nanoparticles for both dental stone (p=0.003) and die stone (p=0.0002). Following

silica nanoparticle addition, there was also a statistically significant reduction of compressive strength of both dental stone (p=0.009) and die stone (p=0.0012).

Keywords: Surface roughness, diametral tensile strength, compressive strength, dental stone, die stone, silica nanoparticles.

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