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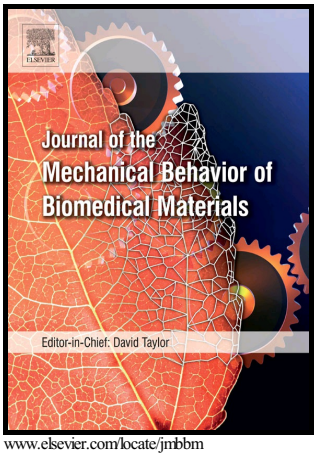

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Mechanical reliability of dental grade zirconia after laser patterning

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Abstract

The aim of this work is to test the mechanical properties of dental zirconia surfaces patterned with Nd:YAG laser interference (λ=532 nm and 10ns pulse). The laser treatment produces an alteration of the topography, engraving a periodic striped pattern. Laser-material interaction results mainly in thermal effects producing microcracking, phase transformation and texturization. The role of such microstructural modifications and collateral damage on the integrity and mechanical performances has been assessed.

Laser patterned discs of zirconia doped with 3% mol yttria (3Y-TZP) have been tested before and after a thermal treatment to anneal residual stresses and revert phase transformation. Both groups of samples behave in a similar manner, excluding residual stresses and phase transformation from the origin of properties modification

Results show that laser patterning induces a minor decrease in mechanical properties and surface integrity of 3Y-TZP surfaces. The biaxial strength decreases as a consequence of the damage induced by laser patterning. Fractographic observations identify preexisting defects enlarged by local laser interaction as the fracture origins. The Hardness and Young modulus of treated surfaces tested with nanoindentation also decrease slightly after laser treatment and this may be attributed to laser-induced microcracking.

Keywords: laser treatment, 3Y-TZP, direct laser interference patterning, mechanical properties.