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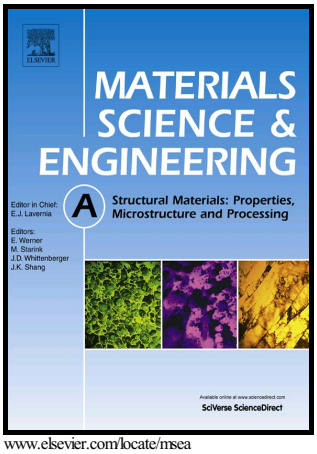

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Roughness and its effects on flexural strength of dental yttria-stabilized zirconia ceramics

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Abstract

This study evaluated the effect of the surface roughness parameters on the flexural strength of Yttria-partially stabilized zirconia, Y-TZP ceramics: ZrO_2 (3 mol%) or ZrO_2 (5 mol%), as function of different surface finishing protocols: polishing or alumina (Al_2O_3) blasting. Zirconia discs were manufactured by CAD/CAM prototyping and sintered at different temperatures. The specimens were characterized by X-ray diffraction, scanning electron microscopy, biaxial flexural strength test and 3D profilometry. In all specimens tetragonal Y_2O_3-ZrO_2 was observed to be the main crystalline phase. The 3D profilometry indicated that alumina blasting of ZrO_2 (3 mol%) increased the roughness R_a around 16-26 times as opposed to the polished surfaces, and approximately 38 times for ZrO_2 (5 mol%) specimens when compared to the polished samples. The results of flexural strength indicate that groups of ZrO_2 (3 mol% Y_2O_3) ceramics present a reduction of 21-23% from polished to alumina blasted specimens. In the group of ZrO_2 (5 mol % Y_2O_3) ceramics, a flexural strength reduction of 37.5% was observed. A correlation between flexural strength, failure size and different roughness parameters: R_a (arithmetic average of the absolute values of the profile heights over the evaluation length), R_z (measure of the ordinates of the five highest peaks and the five deepest valleys along the specimen's length) and *PV (*mean values of peak and valley measured in the specimen space) is proposed and indicates that *Rz* and *PV* should not