Efeito da funcionalização de superfície de zircônias de fase tetragonal e cúbica com diferentes formas de aplicação de nanoestruturas de TiO_2

Objectives: To evaluate the surface and the bond strength of tetragonal (Y-TZP) and cubic (Y-PSZ) zirconia after the application of TiO_2 nanotubes and TiO_2 nanofilms followed by 3-aminopropyltrimetoxisilane (APTMS) application.

Material and methods: Y-TZP and Y-PSZ slices were prepared and divided into the following groups of surface treatments: Nf-A) nanofilm with APTMS; Nf) nanofilm without APTMS; MNt-A) manual application of TiO_2 nanotubes on pre-sintered ceramics followed by APTMS application; MNt) manual application of TiO_2 nanotubes on pre-sintered ceramics without APTMS; VNt-A vacuum manual application of TiO_2 nanotubes on pre-sintered ceramics followed by APTMS application; VNt) vacuum manual application of TiO_2 nanotubes on pre-sintered ceramics without APTMS; Control) group made according manufacturer's instructions. Surfaces were characterized by contact angles measurement (CAM) by the sessile drop technique and scanning electron microscopy (SEM). Bond strength was evaluated by microshear bond strength (SBS) with a universal testing machine after the cementation of resin composite cylinders and 10,000 thermal cycles. Data were analyzed by two-way ANOVA and Tukey tests ($\alpha = 0.05$).

Results: CAM indicated high contact angles for Y-TZP Nf-A, Y-TZP VNt-A, and Y-PSZ Control in comparison with Y-TZP MNt and Y- PSZ VNt-A, which were the lowest. SEM analysis showed the presence of crust-like structures for nanofilm treatments and amorphous cluster formations for nanotube treatments, in contrast to the smooth surfaces of control groups. For SBS, Y-TZP VNt yielded the greatest bond strength while Y-TZP MNt-A, Y-TZP VNt-A, Y-PSZ MNt-A, e Y-PSZ Nt-A were the lowest.

Conclusion: Among the surface treatments tested in the present study, nanotube applications with vacuum showed promising results for Y-TZP, promoting a better bonding interface. Experimental silanization was only effective with nanofilm surface treatments and failed for both nanotube treatments.

Keywords: Ceramics, Nanotechnology, Nanotubes, Shear Strength.