Tribological behaviour of antimicrobial surfaces for orthopaedics and oral rehabilitation

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Inflammatory reactions around implants and prosthetics can occur due to the accumulation of pathogenic bacteria species. The long-term success of implants and prostheses depends on the healthy state of surrounding mucosa, bone, and connective tissues, that can be controlled by manufacturing surfaces with specific physical-chemical aspects to prevent the accumulation of bacteria. Among several properties, the frictional response and the wear resistance reveal fundamental importance in the clinical performance of new surfaces when subjected to complex stresses (compression, traction, shear and bending) arising from human body activity.

The purpose of this study was to evaluate the friction and wear of antimicrobial coatings for implants and prosthetics. In this work, textured and non-textured Ti6Al4V and zirconia substrates were coated with zinc oxide (ZnO) and titanium dioxide (TiO_2) thin films produced by reactive magnetron sputtering, to achieve an antimicrobial potential.

Pin-on-plate reciprocating sliding tests were performed in presence of physiological serum involving dissimilar pairs of functionalised surfaces against cortical bovine bone. The normal load was set on 1 N and sliding occurred at 1 Hz of reciprocating frequency at 16 mm stroke length for 5 min. Particular attention was given to static coefficient of friction (COF) to correlate results with the primary stabilization over the implant placement. Also, the COF evolution was monitored along the sliding test to evaluate the removal process of the antimicrobial coating. The dominant wear mechanisms were characterized by scanning electron microscopy (SEM). In terms of friction, it was found that the texture and nature of the substrate have a significant influence on the static COF response of antimicrobial coatings against cortical bone.

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