Wear of femtosecond laser treated ASTM F 138 stainless steels for orthopaedic applications

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Advances in biomedical engineering research have made possible the reconstruction of various parts of the human body using biomaterials. These devices, when in contact with human tissue, suffer constant wear and corrosion risks, may cause hypersensitivity, or need further surgery for replacement. The present study evaluated the influence of femtosecond laser treatment on the tribological behaviour of ASTM F138 austenitic stainless steel (SS). For comparison reasons, surfaces without laser were also evaluated. A phosphate buffer solution (PBS) of pH 7.4, which simulates body fluid, was used for lubrication. Surface was analysed by stereoscopy and scanning electron microscopy coupled to an energy dispersive X-ray spectrometer (SEM-EDX). All tests were conducted using as counterbodies spheres of the biomaterials widely applied for orthopaedic implants, such as AISI 316L SS, polypropylene and ceramics, in order to analyze the ASTM F 138 SS response to wear.

The wear tests were carried out for 10 min, with 10 s to 10 s of slurry, at a frequency of 75 rpm.

The results showed that the coefficient of friction in ball-cratering wear tests is influenced by the femtosecond laser treatment, normal forces and the type of counterbody.

Key-words: Biotribology, femtosecond laser, orthopaedic implants, ball-cratering.