Biotribological behaviour and cytotoxicity evaluation of laser and mechanically marked biomaterial

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Marking techniques are used to ensure identification and traceability of a biomaterial. The present study evaluated the influence of laser and mechanical marking process on the tribological behaviour of ASTM F139 austenitic stainless steel (SS) on the friction coefficient and wear coefficient in ball-cratering wear tests. The laser marking process was carried out with a nanosecond Q-switched Nd: YAG laser. The citotoxicity of the marked ASTM F 139 SS was analyzed in order to determine if the marking process current used in industry affects the biomaterial's biocompatibility. For comparison reasons, surfaces without marks were also evaluated. A phosphate buffer solution (PBS) was used as electrolyte.

The sample's surfaces finishing were analyzed by optical microscopy.

The wear tests were carried out during 10 min with PBS drip from 10 s to 10 s, at a frequency of 75 rpm, solid spheres of AISI 316L SS and polypropylene, with 1 inch in diameter, were used as counter-bodies.

The results indicated that the tribological behaviour is influenced by the type of the marking process used for this biomaterial, and the wear rate is dependent of the normal force and the kind of sphere. The surface characterization showed microstructure modification due to the high temperatures involved in the laser melting process. None of the samples, either marked or unmarked, were considered cytotoxic, but the laser marked surfaces showed the lowest cellular viability among the tested surfaces.

Key-words: Biomaterials, citotoxicity, marking process, Nd: YAG laser, tribology.