Wear of Antibacterial Coatings on CoCrMo under Butterfly Motion and Dynamic Loads in a Biotribometer

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Conventional tribometers with an unidirectional motion and fixed load are not suitable to investigate wear behavior of implant materials. We have designed a biotribometer that is compatible with physiological dynamic loads (250 to 400 N) and multi-direction motion (butterfly stroke), to investigate the wear behavior of antibacterial coatings on CoCrMo. The counter body was an UHMWPE pin and the lubricant used was calf serum at 37 °C. Friction and wear behavior of these coatings were monitored for 10^6 cycles. In general, the deformation and wear rate of UHWMPE was in the same order as that of clinical reports on UHMWPE cup penetration and wear rate. The friction coefficient was in the range of 0.04 to 0.10. Results from the biotribometer showed the differences between coating A and B. Coating A had increased the wear rate of UHMWPE by a factor of three compared with coating B. Furthermore, the post-test wear images showed severe scratches on the coating A compared to coating B (see Figure 1A). However, these coatings showed no significant differences in the Co or Cr ion release from CoCrMo substrate (see Figure 1B). This study shows that biotribometer can mimic the wear behavior of implant materials, it was used for selection of wear resistant antibacterial coating, that was coating A.

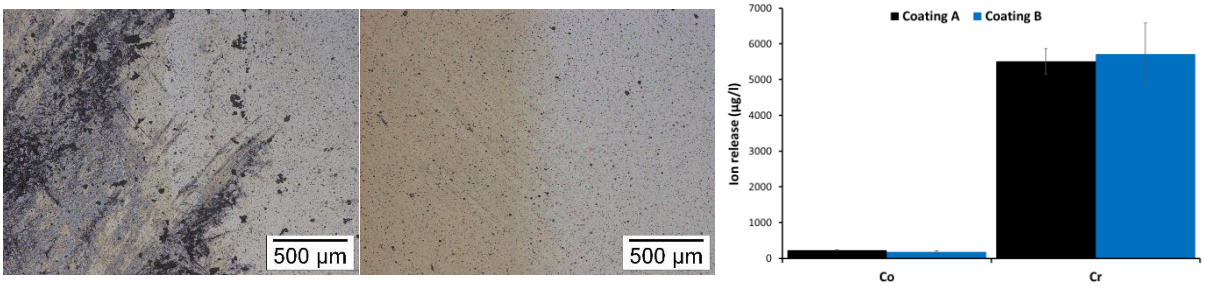

Figure 1. (A) Microscopy images of Coating A (left) and Coating B (right) on CoCrMo disks after 1 million cycle wear tests. The images show one representative test per type. (B) Cobalt and chromium ion release in the bovine calf serum after 1 million cycle. The serum was collected from each station and analysed at every change. The data represent the average of 5 tests per type over 1 million cycle wear tests.

BioTribometer

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