Proceedings of the 6th Asia International Conference on Tribology, pp. 1-2, September 2018

Relationship between friction and wear of dental implant materials

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Keywords: Dental tribology; Implants; Biotribometer

ABSTRACT – Failure of dental implants is largely influenced by its friction and wear behaviour. However, the relationship between friction and wear is to be investigated, yet. For this purpose, we have used a multi-station Biotribometer that can acquire friction while simulating the oral chewing load cycles (half-sine waves, 20 to 200 N – see Fig. 1) between the ball (Zirconia) and a reciprocating disk (Titanium-alloy: Ti-6Al-4V or Stellite-alloy). Optical microscopy was used to measure the wear scar width on the disk and ball. Friction coefficient at the end of the test for Titanium and Stellite was 0.60 ± 0.05 and 0.45 ± 0.08, respectively (see Fig. 2). Mean wear scar width of the Zirconia ball rubbed against Titanium and Stellite was 1850 ± 25 µm and 680 ± 13 µm, respectively. Looking into the evolution of friction, only for the Titanium alloy, friction coefficient increased linearly at a rate of 0.031 per unit of sliding distance. And, wear on Titanium increased at a rate of 480 µm per unit of friction energy which is twice the rate of wear on Stellite. Wear profiles on Zirconia and Titanium represents spalling and deep grooves. This study will be useful in development of coatings for dental implants that reduce its failure.

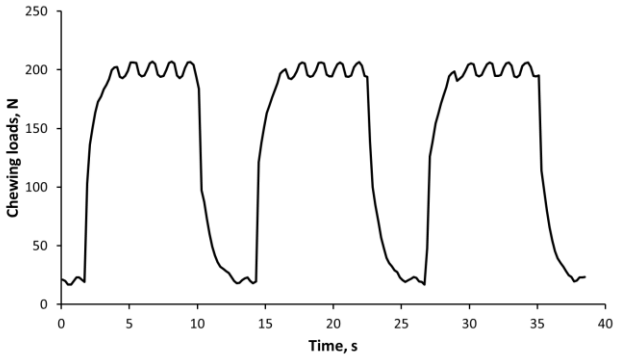

Figure 1. Artificial chewing cycle simulated with Ducom Biotribometer.

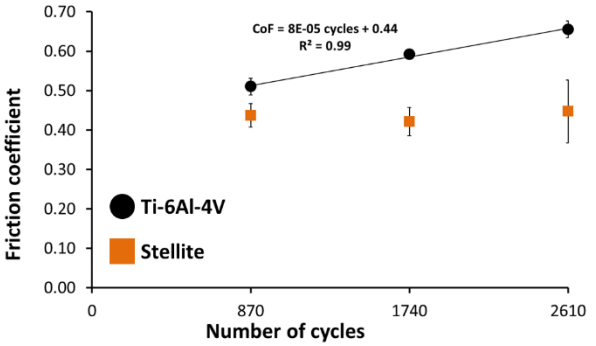

Figure 2. Evolution of friction coefficient of Ti-6Al-4V and Stellite over the test.