ABSTRACT

Yurdakul, B. (2026). In Vitro Evaluation of the Use of Ultrasonic Scalers, Titanium Brushes and Erbium Lasers for Implant Surface Debridement. İstanbul University, Institute of Health Sciences, Department of Periodontology. PhD Thesis. İstanbul.

The treatment of peri-implantitis is difficult because of the complex micro- and nanoscale surface of implants and no standard debridement protocol has been defined for its treatment. This study evaluated five methods used for the debridement of implants explanted because of peri-implantitis. Twenty-five implants, five per group, were cleaned using a carbon fiber ultrasonic insert, a polyetheretherketone (PEEK) ultrasonic insert, a titanium brush, an erbium, chromium-doped yttrium, scandium, gallium and garnet (Er,Cr:YSGG) laser and an erbium-doped yttrium, aluminum and garnet (Er:YAG) laser, while five never-used implants constituted the control group. The implants were examined under scanning electron microscopy (SEM) and the resulting images were assessed with the Modified Implant Debridement Visual Index (M-IDVI) to measure the debridement effectiveness of each method. The elemental composition of the surface was determined by energy-dispersive X-ray spectroscopy (EDS) as the atomic percentage (at%) of carbon, titanium, oxygen and nitrogen. In general, the mechanical methods were more successful than the laser methods at removing debris. Among all the methods, the titanium brush left the least residual debris (M-IDVI: 2.33 ± 0.33) and produced the greatest decrease in atomic carbon percentage (Δ = −7.77 at%). After treatment, the atomic titanium percentage increased in all methods except the Er,Cr:YSGG laser (Δ = −5.9 at%). Although the Er:YAG laser was the most successful method at preserving the original SLA microtopography, its cleaning performance (M-IDVI: 3.27 ± 0.83) was lower than that of the mechanical methods. None of the methods achieved the profile of a pristine implant.

Key words: peri-implantitis, debridement, in vitro, scanning electron microscopy,

energy-dispersive X-ray spectrometry