Visualising and measurement of surface effects on titanium implants by different curettes – a scanning electron and confocal laser scanning microscopic in vitro study

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Introduction
Plaque accumulation on dental implants is influenced by surface properties and can cause periimplantitis and loss of implants. The surface can be damaged by hygiene procedures. The roughness on implant abutments before and after instrumentation with various professional dental hygiene instruments was to analyse by scanning electron (SEM) and confocal laser scanning microscopy (CLSM).

Material and Methods
A steel (SH) and a carbon hand-scaler (CH), a steel- (SU), carbon- (CU) and diamond-coated (DU) ultrasonic scaler (Satelec, Mérignac, France) were used on IMZ transmucosal Ti-implant extension under standardized procedures imitating cleaning conditions (continuous force of 3 N: SH/CH and 0.2 N: SU/CU/DU). The qualitative surface effects were studied by SEM (LEO 435VP, Germany). CLSM (Aristoplan, Leica, Germany) was used to quantify the resulting surface roughness (Ra-values in µm - DIN 4768).

Results
SEM: The surfaces of an untreated and 5 treated abutments are shown in Fig. 1-6. The estimated qualitative surface alterations were rated and assigned to 3 groups (tab. 1, column 2). CLSM: Analogue areas were analysed by CLSM, the roughness (Ra-value) was measured in a standardised and randomised approach in up to 16 fields. The results are shown in (Fig. 7) and Tab. 1, column 3. Statistics: Median locations were compared via two sample Wilcoxon-test. The p-values of each pairwise comparison are shown in Tab. 2.

Conclusion
All included kinds of instrumentation increased the surface roughness as reported. The degree of increase was depending on the chosen instrument. The roughest surface resulted from the diamond-coated tip of the sonic scaler. The smoothest surface coincided with carbon instruments (hand or sonic driven instruments did not differ mainly). The steel scalers showed intermediate Ra-values. The cleaning efficiency of the various instruments was not the aim of the study, remains mostly unclear and needs further investigations. If the clinically expected advantage of the ultrasonic driven instruments can be ensured and if the user keeps the bio-physical effects of ultrasound in dentistry in mind the ultrasonic carbon scaler could be a possible alternative to hand instruments for cleaning implant surfaces.

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