CLINICAL ORAL IMPLANTS RESEARCH

Effects of multiple reuse, remounting and consecutive autoclave sterilization on Osstell SmartPegs

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Background: The resonance frequency analysis (RFA) is an objective and non-invasive method to measure implant stability. To achieve the data a commercially manufactured attachment (Osstell, Sweden) made of aluminum with a magnetic part on the top (SmartPeg) has to be mounted on the inner threads of the implant after insertion and/or after uncovery. A higher frequency correlates to less micro-mobility of an implant or in other words indicates a higher implant stability. The resonance frequency is shown on a monitor as a numerical figure, the Implant Stability Quotient (ISQ). These measurements are highly reliable regarding reproducibility. The SmartPeg is made of aluminum because it is not supposed to jeopardize or damage the threads of the implant even if incorrectly attached/inserted. Despite the recommendation of the manufacturer that these parts are designed for single session use only, many practitioners reuse the device after autoclave sterilization. This leads to unintended effects like unequal ISQ values compared to single used SmartPegs and sooner rather than later to a manipulation of the aluminum made threads of the SmartPeg.

Aim/Hypothesis: The aim of this study was to find physical effects on the SmartPeg device like the heat from consecutive autoclave processes on the magnetic part and the multiple mechanical load for the aluminum made threads of the device.

Material and methods: Five SmartPegs underwent 20 consecutive autoclave and remounting processes. Between the autoclave processes the SmartPegs were mounted on a Camlog Implant (4.3 × 13) with the recommended torque of 4–6 Ncm, ISQ measurements were performed and recorded. After that the Smartpegs were again unscrewed for the next autoclave process. SEM images of these 'reused' SmartPegs and new control samples were taken. Region of interest were the screw threads to detect friction traces on the soft aluminum from the titanium made implant threads. All samples were loaded in a Zwick servo-hydraulic testing machine for fatigue fracture testing. Fracture dynamic was recorded and fracture-lines were analyzed with SEM.

Results: The fatigue fracture testing showed no significant differences between the reused, consecutive autoclave sterilized samples and the control group. Unequal ISQ data occurred that can possible originate from the heat sensitive magnet or the less precise fit of the SmartPeg after multiple remounting processes. However, the effects of the multiple remounting processes were significant. While one or two remounting processes of the SmartPeg had no influence on the threads, friction traces increased dramatically after five and more remounting processes on the aluminum threads and could be seen even in lower magnification in the SEM images. Aluminum particles may detach after five or more reuses and remain in the inner part of the implant. This may lead to an early loosening of the abutment screw which in turn leads to all well known subsequent complications to the patient and the practitioner. The consequences of multiple autoclave processes and reuse of the SmartPegs counteract the benefits of the ISQ measurement.

Conclusions and clinical implications: The multiple reuse of Osstell's SmartPegs, numerous remounting processes and consecutive autoclave sterilization have significant effects on the device and should be avoided. Only minor savings on the economic side have to pay for less precise and reliable ISQ data and for serious prosthetic complications due to detached aluminum particles that could finally prevent or make it almost impossible to realize a precise fit and stability of the abutment.