Effectiveness of artificial calculus removal after dental implant instrumentation. An in vitro study.

Benyapha Sirinirund4, Carlos Garaicoa-Pazmino1, Hom-Lay Wang1

1Department of Periodontics and Oral Medicine, University of Michigan School of Dentistry, Ann Arbor, MI, USA.

ABSTRACT

Aim: The aim of the present study was to evaluate the various instruments effectiveness for artificial calculus removal assessed by stereomicroscopy.

Materials & Methods: Fourteen dental implants were coated with mixture of cyanoacrylate and Toluidine blue dye (1:1 ratio) resembling calculus. The artificial calculus was applied on the coronal 1/3 of 7 roughed- and 7 machined-surface implants. Two pristine implants without any surface alteration were used as controls. Implants were instrumented by 3 commercially available curettes (SS: stainless steel, P: plastic, Ti: titanium), 2 ultrasonic tips (UM: metal tip, UP: plastic tip), a Titanium brush (TB) and a glycerine powder air-polishing device (AA; Air-Flow®, Hu-Friedy) until visible clean or for a maximum time of 10 min.

RESULTS

• A mixture of cyanoacrylate and toluidine blue dye in a 1:1 ratio was made to resemble heterogeneous, adherent deposit and deposited on the coronal 1/3 of 7 roughed- (Tapered Screw-Vent, MXT®, Zimmer Biomet) and 7 machined- (SLActive Tissue Level, Straumann) surface implants (Fig. 1).
• All implants were instrumented with 7 commercially available instruments (Fig. 2) until visible clean or for a maximum time of 10 minutes.

SUMMARY

• Artificial calculus removal was proven to be clinically feasible with all instruments with the exception of plastic curettes. Effectiveness of deposit removal seemed to be influenced by implant macro- (e.g. threads) and micro-design (e.g. surface treatment).
• Alteration of implant surface was noted at different degrees with all instruments.
• Majority of residual deposit on roughed-surface implants were located between threads. Hence, it is more practical to use instruments in combination with titanium brush or air-abrasive device to enhance cleaning efficacy.
• Findings from the present study may impact on protocols for implant cleaning in order to maintain implant health without deposits.

INTRODUCTION

Bacterial biofilm has been addressed as the main etiology for peri-implant diseases (Fig. 1). Limited evidence providing effectiveness of commercially available instruments on removing adherent deposit and topographical changes upon dental implants is available. There is no clear consensus for implant cleaning protocols and how to perform them. Hence, the present study evaluated the effectiveness of available instruments for artificial calculus removal and their impact on implant surface alteration.

METHODS

- UM revealed to be the most effective for artificial calculus removal with the lowest cleaning time of 143 seconds. Despite its effectiveness, UM created the most obvious surface alterations.
- P is the only instrument that cannot remove any deposits after 10 minutes of cleaning.
- Among 3 types of curettes, SS can remove the deposit more effectively (30.87%) while Ti left more remnants (40.24%) on roughed-surface and P failed to remove deposits (100%) in all surfaces.
- Minimal remnants of 9.81% and 5.79% were observed in roughed-surface implant cleaned by UP and TB, respectively.
- AA can remove the deposit on roughed surface (0%) more effectively than machined surface (26.61%). Additionally, AA produced minimal or no damage to both surfaces.

ACKNOWLEDGEMENTS

The present research was supported by the Department of Periodontics and Oral Medicine at the University of Michigan, Ann Arbor, MI and Hu-Friedy Mfg. Co., LLC, Chicago, IL.

Figure 1: Clinical photographs of implants with peri-implants before (A) and after (B) cleaning with hand instrumentation and an ultrasonic device.

Figure 2: (A, B) Pristine roughed and machined surface implants. (C, D) Artificial calculus was applied on all fourteen implants.

Figure 3: Seven instruments include 3 types of curette (Stainless-steel SS, Titanium Ti, Plastic P), an ultrasonic device with metal (UM) and plastic (UP) tips, titanium brush (TB) and air-abrasive device (AA) with glycerine powder.

Figure 4: Photographs of roughed and machined surface implants after cleaning with seven instruments.

Figure 5: Areas of residual artificial calculus of all implants were calculated by using number of pixels at the most focused area on mid-section of each implant.