Göteborg, 2023

Decontamination of implant surfaces

Akademisk avhandling

Som för avläggande av odontologie doktorsexamen vid Sahlgrenska akademin, Göteborgs universitet kommer att offentligen försvaras i F-sal 3, Medicinaregatan 12E, den 3 Maj 2023, klockan 9.00

av

Yuki Ichioka

leg. tandläkare

Fakultetsopponent:
Professor Jan Eirik Ellingsen
Oslo universitet, Norge

Avhandlingen baseras på följande delarbeten

I. Yuki Ichioka, Jan Derks, Gunnar Dahlén, Tord Berglundh & Lena Larsson. (2022). Mechanical removal of biofilm on titanium discs: An in vitro study. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, 110(5): 1044-1055.

II. Yuki Ichioka, Jan Derks, Gunnar Dahlén, Tord Berglundh & Lena Larsson. (2021). In vitro evaluation of chemical decontamination of titanium discs. *Scientific Reports*, *11*(1), 22753.

III. Yuki Ichioka, Leire Virto, Paula Nuevo, Juan Daniel Gamonal, Jan Derks, Lena Larsson, Mariano Sanz & Tord Berglundh. Decontamination of biofilm-contaminated implant surfaces: An *in vitro* evaluation. (In manuscript)

IV. Yuki Ichioka, Jan Derks, Lena Larsson & Tord Berglundh. Surface decontamination of explanted peri-implantitis-affected implants. (Submitted for publication)

SAHLGRENSKA AKADEMIN
INSTITUTIONEN FÖR ODONTOLOGI

GÖTEBORGS UNIVERSITET

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Decontamination of implant surfaces

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Abstract

Peri-implantitis is a pathological condition occurring in tissues around dental implants. It is caused by microorganisms and characterized by inflammation in the peri-implant connective tissue and progressive loss of supporting bone. The goal of treatment of peri-implantitis is to resolve inflammation and to arrest further loss of supporting bone. Removal of the bacterial biofilm from the implant surface is a prerequisite to achieve this goal. The aim of the present series of studies was to evaluate the efficacy in biofilm removal of different implant surface decontamination methods.

In **Studies I and II**, different mechanical and chemical decontamination protocols on biofilm-coated titanium discs were evaluated. It was demonstrated that air-polishing and rotating titanium brush were the superior mechanical methods, while alkaline electrized water (AEW) and N-acetyl-L-cysteine were the most effective chemical agents. In **Study III**, different combinations of mechanical protocols and chemical agents were examined using commercially available implants covered with a multispecies biofilm. Decontamination protocols including an air-polishing device or a rotating titanium brush were superior in terms of biofilm removal and in reducing atomic% of Carbon on implant surfaces when compared to methods restricted to wiping with gauzes. The use of chemical agents as adjuncts to the mechanical cleaning protocols provided no relevant benefit over saline. **Study IV** evaluated the cleaning efficacy of air-polishing and a combination of air-polishing and AEW in surface decontamination of explanted peri-implantitis-affected implants. SEM analysis revealed that both treatment protocols were effective in biofilm removal. While differences between treatment protocols were small, implant thread geometry, implant surface characteristics and gender influenced results. In addition, EDS analysis showed that target zones of the implant (apical, middle, coronal) influenced the atomic% of Carbon and Calcium and that implant surface characteristics affected the atomic% of Titanium.

The present series of *in vitro* studies demonstrated that both air-polishing and rotating titanium brush are effective tools in removing biofilm from implants. Clinical studies are needed to assess the efficacy of the implant surface decontamination protocols during surgical treatment of peri-implantitis.

Keywords: Dental implant, peri-implantitis, surface decontamination

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