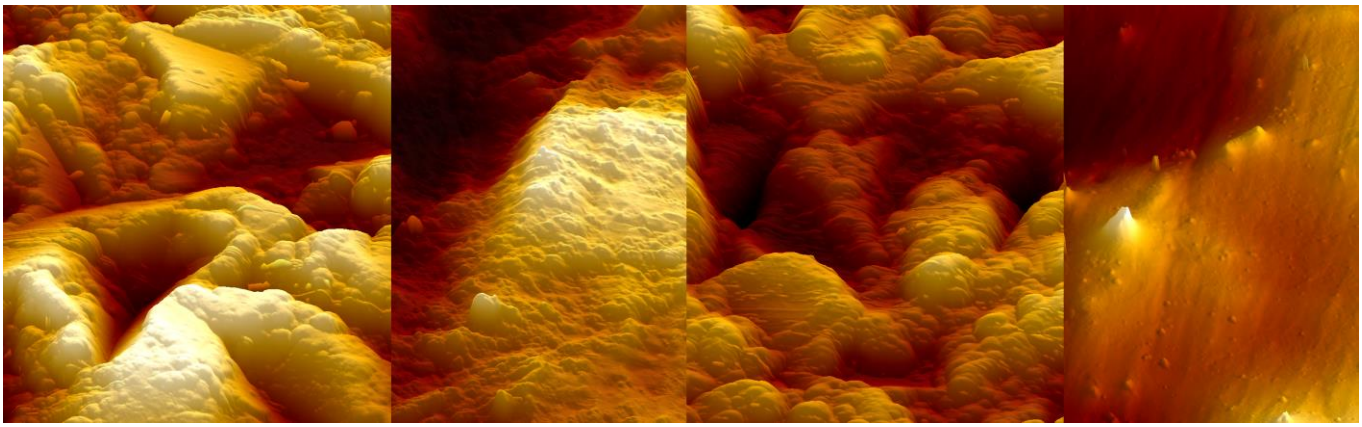
TURUN YLIOPISTO



Dental materials development project: titanium, silica, and silane interactions

Biocompatibility with bioactive properties (positive osseointegration), along with good mechanical properties, high corrosion resistance, and low relative density make titanium a material of choice for biomedical applications. It is widely used in dentistry as implant fixtures, implant abutments, crowns, bridges (FPDs), and removable partial dentures (RPDs).

The lifespan of cementation on titanium prostheses depends on how durable the adhesion is between the resin composite cements and titanium. Titanium prostheses do not have natural adhesion capability with resin composite cement but need surface modifications before cementation. The purpose of surface modifications on titanium is to create surface roughness for greater mechanical interlocking and to change surface chemistry for better chemical bonding with resin cements. Silica-coating, acid-etching, and silanization can be used to increase bonding (adhesion) strength, but the full understanding of the process is not yet available.

The objective of our research is to introduce dual surface modification procedure of titanium substrate, silica-coating plus acid-etching. This method might create a new type of surface on the titanium, which after priming with a silane, would lead to the formation of durable and long-lasting bonding between titanium and cement.

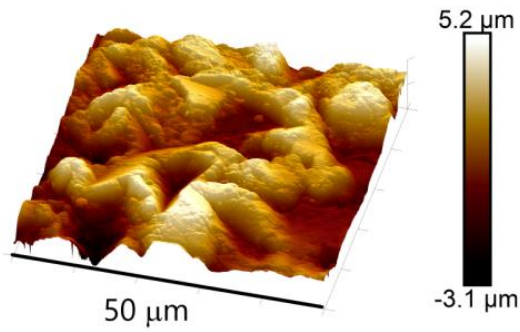
In this study, a total amount of nearly 200 c.p grade 2 titanium samples were polished, silica-coated, acid-etched, silanized, and analyzed. In essence, different sequences of silica-coating and acid-etching, different acid treatment protocols, and different silanes were compared and contrasted, and their effect to the bonding strength was evaluated.

We can conclude that chemical adhesion in synergy with retention (interlocking) due to surface roughness plays a vital role for durable adhesion.

Some of our results have been published in the doctoral thesis of Dr. Muhammad Zakir (HKU, 2018) and we will soon publish more results in several scientific articles.

Analysis methods of this work include:

- Profilometer
- Atomic Force Microscopy AFM
- Scanning Electron Microscopy SEM
- X-ray photoelectron spectroscopy XPS
- Energy dispersive X-ray analysis EDS
- Enclosed mold micro-shear bond strength analysis EM-μSBS



This showcase is based on the cooperation of the Materials research laboratory at the University of Turku (UTU) and Dental Materials Science unit at the University of Hong Kong (HKU). As the supervisor acted Prof. Jukka Matinlinna from HKU and from the University of Manchester (UK).

Contact for more information: www.utu.fi/casualbee