Antibacterial effect of structured titanium surfaces using ultrashort pulsed direct laser interference patterning

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Titanium is a ubiquitous surface material for medical implants (e.g., dental implants, stents, and orthopedic devices), but also a common ground for implant associated infections (IAI), demanding surface modifications that reduce microbial adhesion to the implant material[1-8]. Here we report on a heat treatment and laser-based structuring method producing a microstructured titanium surface that displays a reduced binding capacity for bacterial biofilm-formers such as *Escherichia coli* and *Staphylococcus aureus*.

Titanium surfaces were first heat-treated to ensure a titanium dioxide (Rutile) layer formation and subsequently microstructured using ultrashort pulsed direct laser interference patterning (DLIP)[6-10]. Surface topographies of all processing steps were characterized by different methods, including scanning force microscopy (SFM). The surfaces were subsequently tested for their bacterial binding capacities by classical microplate-based adhesion assays and single cell force spectroscopy (SCFS).

We found that a titanium dioxide layer produced by heat treatment already reduced the capacity of the bacteria to stick to the surface, which could be further reduced when the heat-treated titanium surfaces were also microstructured by DLIP.

Our findings may help to create novel titanium-based implants that display a reduced risk for bacterial biofilm formation and thus IAI.

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