

White Paper WP-8

SurfLink® Dental layer thickness and implant surface roughness characterisation

1. Introduction

SurfLink® Dental surface treatment by NBMolecules® has been validated for a variety of oxide surfaces[1]. Following surface treatment, the SurfLink® molecule binds covalently to titanium resulting in a highly hydrophilic surface, as presented separately in NBMolecules® White Paper[2].

The aim of this study was to further characterise the surface of SurfLink® Dental treated implants to demonstrate that implant dimensions and surface topography characteristics are unaffected by SurfLink® Dental surface treatment.

2. Materials and Methods

The following techniques were implemented to characterise SurfLink® Dental treated titanium (grade 4) implants:

XPS (X-ray Photoelectron Spectroscopy) Depth Profile: The thickness of the SurfLink® layer was determined using a Kratos Axis Nova spectrometer (Kratos Analytical, Manchester, UK). Depth profiling by ion-milling (i.e. high energy ion bombardment) at the calibrated rate of 6 nm/min, was performed by scanning an Argon-ion beam over an area of 4 mm×4 mm.

Roughness measurement (line optical profilometry): Surface roughness of SurfLink® Dental treated implants and control implants was investigated with a µSurf confocal microscope (NanoFocus AG, Germany).

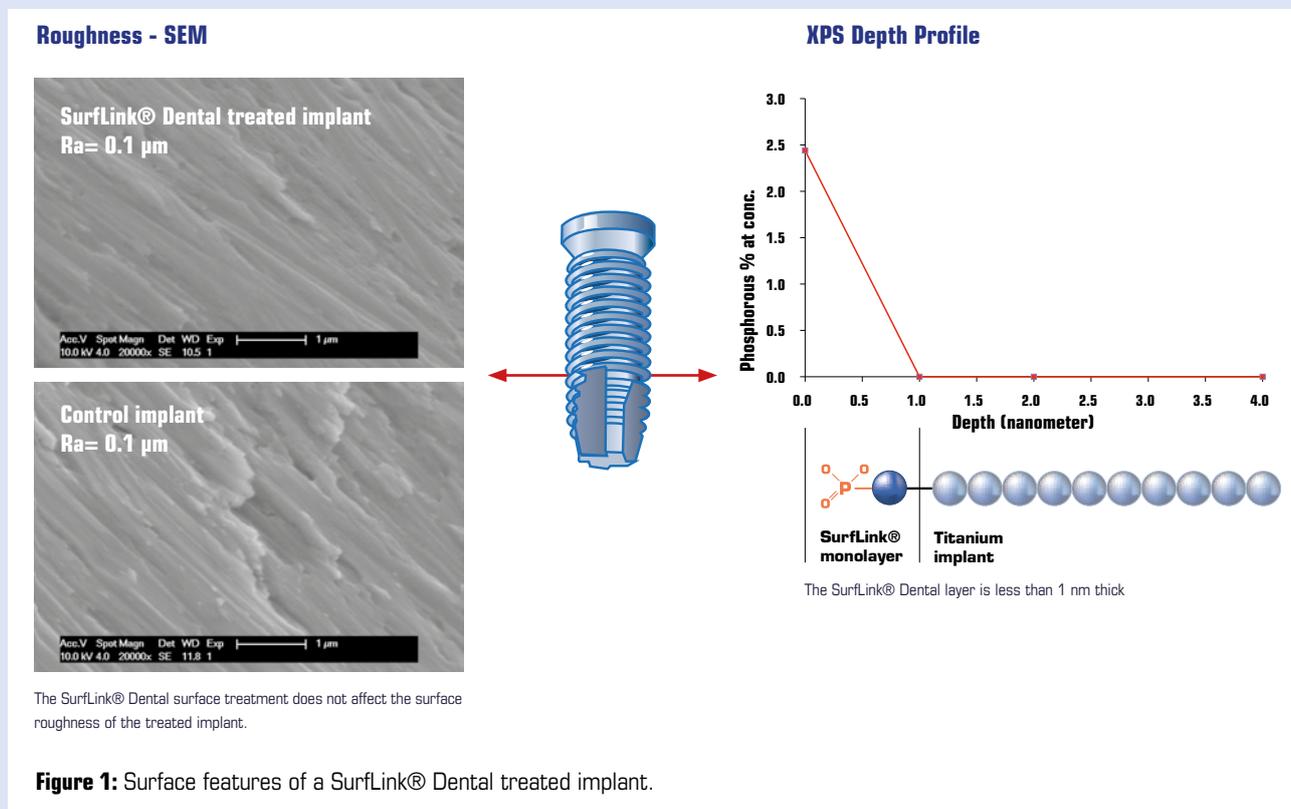
SEM (Scanning Electron Microscopy): High magnification images of the surface of SurfLink® Dental treated implants and control implants were acquired by SEM Oxford Instruments (INCASynergy 350 Oxfordshire, UK).

3. Results

Analyses of SurfLink® Dental treated titanium implants showed (see also Figure 1):

- **XPS Depth Profile:** The intensity of the phosphorous peak was monitored by XPS as the surface was ion-milled. The results showed that phosphorous (i.e. SurfLink®) binds to the outermost surface of the implant. After 10 seconds of ion-milling the phosphorous peak disappears, indicating that the SurfLink® layer is less than 1nm thick. Given the size of a SurfLink® molecule, this result confirms that only a monolayer of SurfLink® was present.
- **Roughness measurements and SEM:** The surface roughness of SurfLink® Dental treated implants ($R_a=0.1\mu\text{m}$) is equivalent to that of control implants ($R_a=0.1\mu\text{m}$). As seen in the SEM images, the surface features, which are the result of the implant machining, remained after SurfLink® Dental surface treatment.

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4. Conclusion

SurfLink® Dental surface treatment by NBMolecules® produces a SurfLink® monolayer less than 1 nm thick. SurfLink® Dental surface treated implants have exactly the same implant dimensions, topographical and roughness characteristics as the untreated implant. Thus surgical implant site preparation remains the same as for an untreated implant.

5. References

- [1] NBMolecules® White Paper WP-3 SurfLink® Dental Surface Treatment of a variety of dental implants, 2011.
- [2] NBMolecules® White Paper WP-1 Surface Characterisation of SurfLink® Dental treated titanium implants, 2011.

This document is part of a series of NBMolecules® White Papers (WP) covering in vitro, in vivo and clinical studies on SurfLink® Dental surface treatment. For the complete set of current White Papers, please consult www.SurfLink.info.

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