

White Paper WP-6

Pre-clinical experimental study with SurfLink® Dental treated implants: Biomechanics

1. Introduction

Stable bone-to-implant interface, and strong mechanical fixation, are essential requirements in reducing implant failure.

Previous studies have provided experimental data demonstrating favourable effects of SurfLink® Dental treatment on implant osseointegration and stability [1,2]. Histological analysis and Scanning Electron Microscopy (SEM) imagery of the cells and bone structures occupying the bone-to-implant interface are presented separately in the NBMolecules® series of White Papers [3,4].

The aim of the present study was to investigate early and late stage biomechanical stability of SurfLink® Dental surface treated titanium implants.

2. Materials and Methods

Dental implants were placed in the left and right pelvis of 24 sheep according to a well-established animal model [5]. This study used implants with a roughened¹ surface finish with either SurfLink® Dental treatment or no treatment (control). Animals were sacrificed after 2, 8 and 52 weeks. Removal torque tests were performed on a servohydraulic biaxial testing machine (MTS Mini-Bionix 358; MTS, Minneapolis, MN, USA). The implant was rotated counter-clockwise and the torque-rotation curve was analysed to define the removal torque value (Nmm) and interfacial (rotational) stiffness (Nmm/degree) [6,7].

3. Results

Removal torque measures the actual shear strength, between bone and implant. Rotational stiffness indicates the “elasticity” of the surrounding peri-implant bone, before torsional forces actually debond the interface or fracture the bone.

SurfLink® Dental treated implants showed greater integration over control implants with higher torque and stiffness values at 2 weeks (+32% and +37% $p \leq 0.05$, respectively, Figure 1 and 2)². Furthermore at 52 weeks, long term fixation and stability continued to be reflected by superior torque and stiffness values (+7% and +21%, respectively, Figure 1 and 2)².

4. Conclusion

SurfLink® Dental treated implants showed enhanced biomechanical fixation at both early and long-term time points. The enhanced fixation is the result of previously demonstrated increased osseointegration of the surface.

In the clinical situation, based on these results, SurfLink® Dental treatment should substantially improve both osseointegration and long-term mechanical stability.

5. References

- [1] R. Dayer et al., Bone, **2005**, 36, S389 (P561).
- [2] NBMolecules®' internal reports, unpublished.
- [3] NBMolecules®' White Paper WP-4 Pre-clinical experimental study with SurfLink® Dental treated implants: Histology, **2011**.
- [4] NBMolecules®' White Paper WP-5 Pre-clinical experimental study with SurfLink® Dental treated implants: SEM, **2011**.
- [5] J.D. Langhoff et al., Int. J. Oral Maxillofac. Surg., **2008**, 37, 1125-1132.
- [6] D. Buser et al., J. Biomed. Mater. Res., **1999**, 45, 75-83.
- [7] S.J. Ferguson et al., Int. J. Oral Maxillofac. Implants, **2008**, 23, 1037-1046.

Footnotes :

1 Roughened by sandblasting and dual acid etching. The roughened surface was chosen as representative of the most prevalent type of surface. Other surface finishes were also studied and results are presented elsewhere.

2 Outcome parameters were evaluated by pairing test implants (surface treated) with the corresponding control in the same animal and statistically evaluated with a one-sample Wilcoxon test, with $p < 0.05$ for significance.

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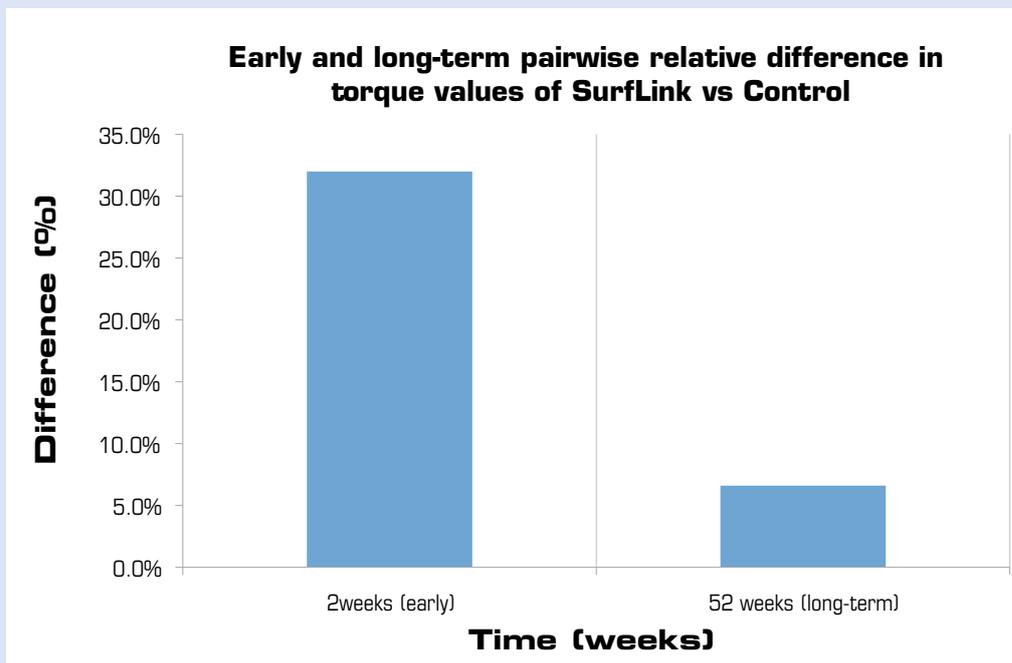


Figure 1: Early and long-term pairwise relative difference in Torque values of SurfLink® vs Control.

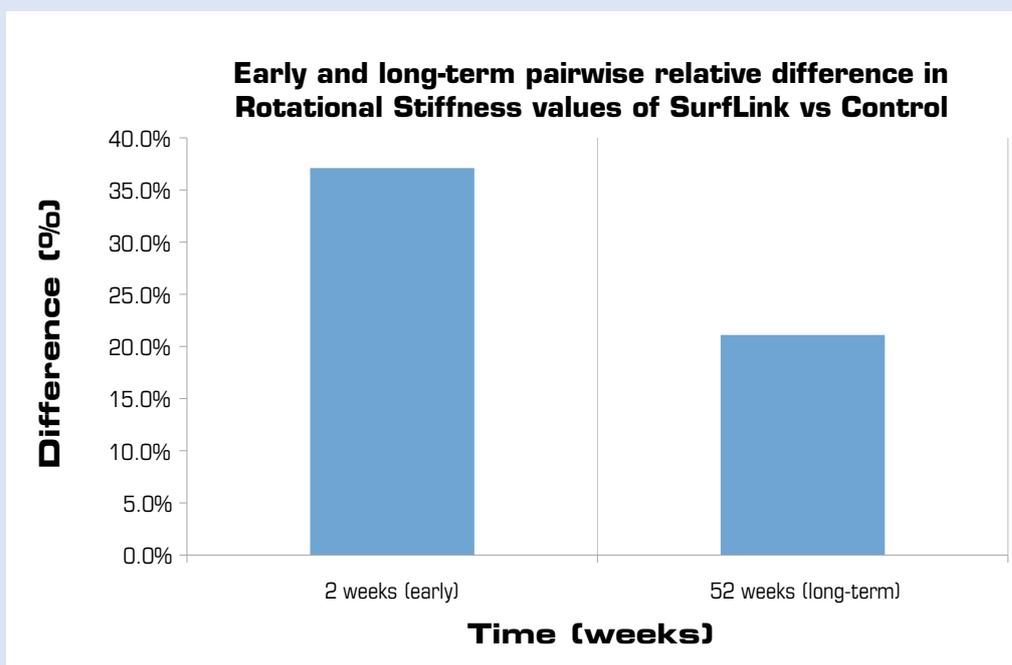


Figure 2: Early and long-term pairwise relative difference in Rotational Stiffness values of SurfLink® vs Control.

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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