

In Vivo Studies in a Rabbit Tibia Model

Increased Fixation and Integration of Titanium

^[A] Jimbo et al. (2011), 'Genetic Responses to Nanostructured Calcium-phosphate-coated Implants', Journal of Dental Research, vol. 90, no. 12, pp. 1422-1427

^[B] Jimbo et al. (2012), 'The biological response to three different nanostructures applied on smooth implant surfaces', Clinical Oral Implants Research, vol. 23, no. 6, pp. 706-712

^[C] Data on file (Study 0123)

Aim

The osseointegration of HA^{nano} Surface modified implants was evaluated in three *in vivo* studies employing implants with different surface treatments at three different time points. The aim of these studies was to investigate bone fixation through removal torque analysis.

2 Weeks: Turned Titanium^[A]

HA^{nano} Surface modified ($S_a=0.20\ \mu\text{m}$) and unmodified ($S_a=0.21\ \mu\text{m}$) turned titanium implants (3.3x8mm) were evaluated in a rabbit model. One modified and one unmodified implant were implanted into the left and right tibia, respectively, of 9 rabbits. Evaluation by removal torque (RTQ) measurements was conducted after 2 weeks.

As shown in the figure on the next page, HA^{nano} Surface modified implants showed a significant increase of RTQ with 35% compared with unmodified implants. This indicates that HA^{nano} Surface enhanced the initial bone responses.

6 Weeks: Blasted Titanium^[B]

Blasted titanium implants (8x4.1mm) were placed in rabbit tibia and evaluated by RTQ after 6 weeks of healing. In total, 12 rabbits were included in the study, each of them receiving one unmodified ($S_a=0.37\ \mu\text{m}$) and one HA^{nano} Surface modified ($S_a=0.40\ \mu\text{m}$) implant.

Six weeks after implantation, HA^{nano} Surface modified implants displayed significantly ($p<0.05$) higher RTQ compared to unmodified

controls (on average +34 %), as can be seen on the next page.

9 Weeks: Blasted and Acid-Etched Titanium^[C]

Blasted and acid-etched titanium implants (4.3x8mm) were modified with HA^{nano} Surface ($n=8$) and placed in rabbit tibia together with unmodified implants (control). Average S_a was 0.91 for test and 1.08 for control, with a standard deviation of 0.20 and 0.41 respectively.

After 9 weeks of healing, the animals were euthanized and RTQ for each implant was evaluated.

The results presented on the next page reveal that HA^{nano} Surface significantly increased the RTQ by 20% ($p=0.05$).

Conclusion

The aggregated results from three *in vivo* studies clearly demonstrate that HA^{nano} Surface facilitates and enhances the osseointegration process during the early phases of healing.

The enhancement can be seen regardless of the underlying surface roughness. It is also shown that the roughness itself is not affected by the application of HA^{nano} Surface. Thus, HA^{nano} Surface can be applied to a range of implants - with rough to smooth surfaces - to accelerate and enhance osseointegration. This may enable earlier loading of implants.

