In Vivo Evaluation of Implant Length and Surface Physico/Chemistry Characteristics in Biomechanical Anchorage in Plateau Root Form Implants. An Experimental Study in Beagle Dogs.

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Since the implant surface is the first part of the implant that interacts with the host, significant attention has been devoted towards increasing the biocompatibility and osseoconductivity of implant surfaces. Surface modification approaches have been successful in increasing the host response to surgical implants, resulting in higher bone-to-implant contact (BIC) and higher bone mechanical properties at early implantation times.

Among surface chemistry modifications, the incorporation of Ca- and P-based bioceramic onto the implant surfaces through various manufacturing processes has been investigated throughout the last two decades. These basic and clinical investigations have shown that bioceramic coated implants presented higher degrees of osseoconductivity and attained higher degrees of biomechanical fixation at earlier implantation times compared to uncoated implants.

The objective of this study was to determine the influence of implant length and surface chemistry (Alumina-blasted/acid-etched (AB/AE) vs. Nanotite™ (Na) bioceramic deposition) on the biomechanical fixation of plateu root form implants in a beagle dog tibia model.

Methods: 4.5x11 mm (L) and 4.5x6 mm (S) plateau root form implants of AB/AE and Na surfaces were placed bilaterally along the proximal tibia of 6 beagle dogs and remained for 2 and 4 weeks in vivo (n=9 per implant length, surface, and time in vivo).(Fig. 1 and 2) Following euthanization, the implants were torqued to interface failure at ~0.445 radians/sec.(Fig. 3 and 4) ANOVA was utilized to determine the effects of implant length, surface, and time in vivo as (independent variables) on torque to interface failure (dependent variable). One-way ANOVA was utilized for direct comparison between groups. A 95% level of significance was used.

Results: trans-surgical bone preparation showed that L implants engaged two bone corticals whereas S implants engaged one cortical. ANOVA showed that all independent variables presented a significant effect in torque to interface (Ncm) failure: Implant length ($P<0.0005$, S=43.75±11.02[a], L=72.02±10.54[b]), implant surface ($P<0.0000$, AB/AE=34.93±10.85[a], Na=80.84±10.7[b]), and time in vivo ($P<0.002$, 2W= 45.51±10.7[a], 4W=70.27±10.85[b]). One-way ANOVA showed significant differences between groups ($P<0.0000$, see Table 01).

Conclusions: according to the results obtained, the Nanothickness bioceramic surface coating played a significant role on biomechanical fixation of L and S implants at both times in vivo. While ANOVA showed a significant effect of implant length on biomechanical fixation, direct comparison between groups showed that this difference was larger for Nanotite coated implants, and not significantly different for uncoated implants.

Fig. 1 and 2

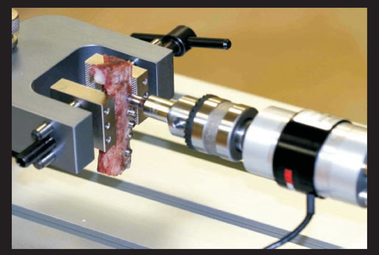

Fig. 3

Fig. 4

	Torque (Ncm) ± 95%CI	
Group	2 Weeks	4 Weeks
S Na	49.13±13.85 [b,c]	66.71±14.81 [b]
S Un	24.18±14.81 [c]	35.17±13.06 [c]
L Na	71.41±13.06 [b]	132.81±13.06 [a]
L Un	40.25±13.06 [c]	38.54±14.81 [b,c]

Table 01

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