

Influence of Surface and Implant Design on Stability of Five Commercial Titanium Implants

A Biomechanical Study in The Rabbit

J Gottlow, DDS, PhD, L Sennerby, DDS, PhD. Academy of Osseointegration 25th Anniversary Meeting, Orlando, FL, USA, March 4-6, 2010 (Abs P193).*

Purpose

The experimental investigation was to compare implant stability as assessed by removal torque measurements between five commonly used dental implants representing different surface characteristics and geometries.

Methodology

- The study was performed in 40 rabbits
- SLActive® implants (test) and implants from 4 different implant systems, all with non-hydrophilic surfaces (control) were evaluated (120 implants at each timepoint of 3 weeks and 6 weeks, i.e., 15 per competitor and 4 x 15 Straumann to allow for direct comparison)

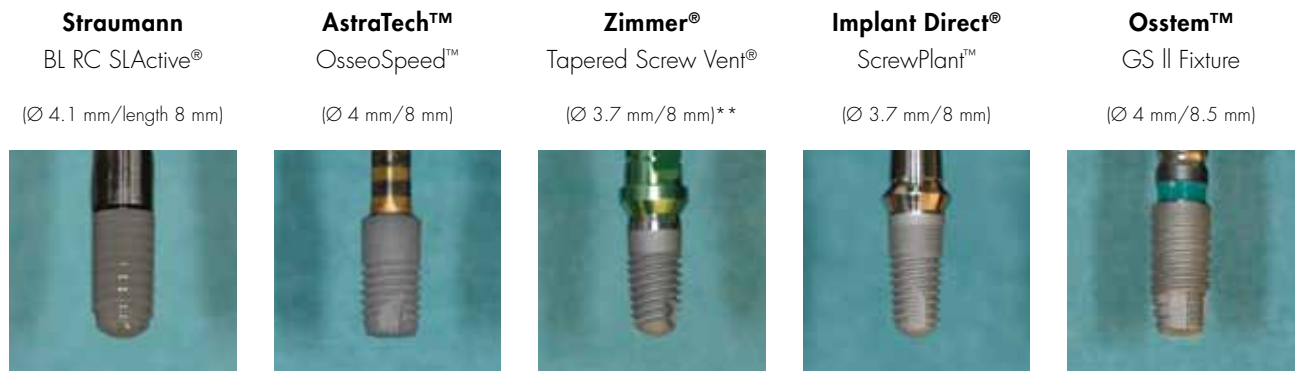


Figure 1

- Split leg/random design allowed the direct comparison of test and control pairs of implants in tibial metaphyses and the distal femoral condyles of rabbits. Test implants (S) were placed in one leg, whereas 3 of 4 control implants (A, B, C and D) were rotated in position and placed in the other leg (n=15)
- The implant stability was assessed by removal torque (RTQ) evaluation after 3 and 6 weeks
- A histological evaluation of the bone healing is currently ongoing

Results

Mean removal torque values of test (S) and control implants (A-D) in figure 2 showed significant differences between SLActive® and all control implants, OsseoSpeed™, Tapered Screw Vent®, ScrewPlant™ and GS II Fixture, for 3 and 6 weeks

(**=p-value ≤0.01; ***=p-value ≤0.001, paired t-test)

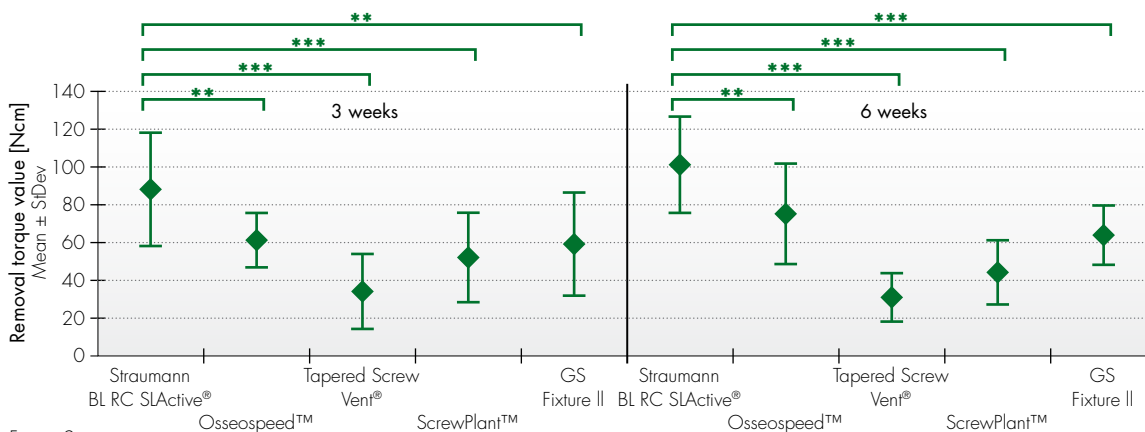


Figure 2

		Straumann BL RC SLActive®	Osseospeed™	Tapered Screw Vent®	ScrewPlanti™	GS Fixture II
Dimensions (µCT)	Mean radius	1.91 mm	1.85 mm	1.64 mm	1.59 mm	1.79 mm
	Length (Cylindrical Part)	7.3 mm	7.5 mm	6.9 mm	7.3 mm	8.1 mm
	Surface Area	104.8 mm ²	110.3 mm ²	98.4 mm ²	99.3 mm ²	120.5 mm ²
3D Roughness (CWLM)	Average mean deviation S _a	1.05 µm	0.60 µm	0.54 µm	0.77 µm	0.64 µm
	Max. peak to valley height S _p	6.91 µm	4.21 µm	3.99 µm	5.48 µm	4.32 µm
	Skewness S _{sk}	0.15	-0.05	-0.28	-0.15	-0.13
Hydrophilicity	Dynamic Contact Angle	0°	138°	120°	112°	124°

Figure 3: Measured surface properties of test and control implants

Calculated shear strength values after 3 and 6 weeks (Mean +/- StDev). Significances: **p ≤ 0.01, *** p ≤ 0.001 paired t-Test.

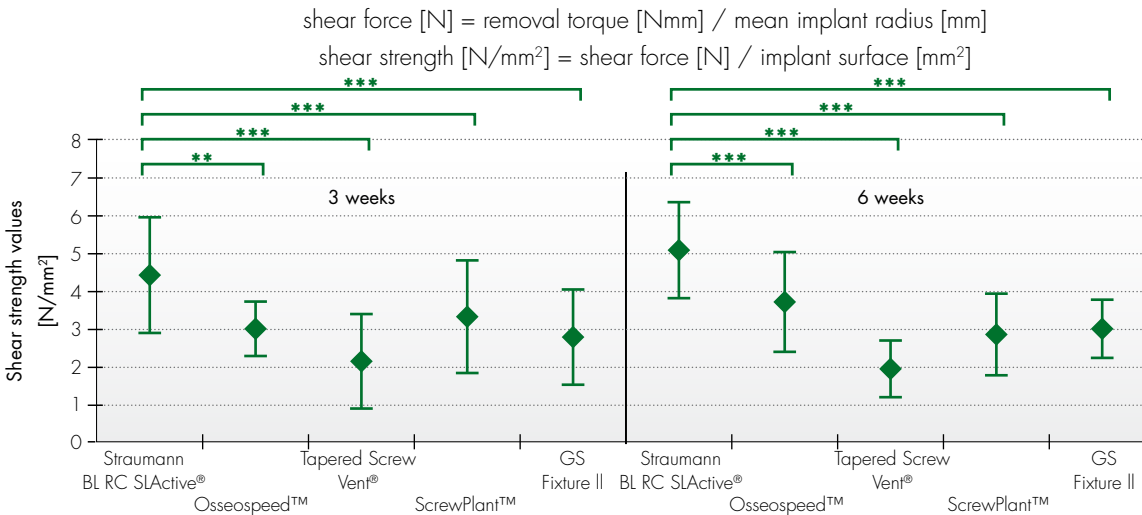


Figure 4: Shear strength (N/mm²) displayed as shear force normalized by surface area

Conclusion

The SLActive® implants showed a significantly higher implant stability compared to the implants with non-hydrophilic surfaces as assessed by removal torque evaluation.

*Figure 1, 2 and 3 has been presented [Gottfrow et al., AO Meeting, Orlando, FL, USA, March 4-6, 2010, Abs P193]

Figure 4: Shear strength values calculated by Institut Straumann AG and approved by authors based on Figure 2 and 3

**Tapered Screw Vent implant is also available with 4.1 mm diameter

OsseoSpeed™ and Astra Tech™ are registered trademarks of Astra Tech AB, Sweden.
Tapered Screw Vent® and Zimmer® are registered trademarks of Zimmer Dental Inc USA.
ScrewPlanti™ and Implant Direct® are registered trademarks of Implant Direct, USA.
Osstem™ is a trademark of Osstem Company Ltd., Seoul, Korea.

SLActive® and/or other trademarks and logos from Straumann® that are mentioned herein are trademarks or registered trademarks of Straumann Holding AG and/or its affiliates. All rights reserved.



International Headquarters

Institut Straumann AG
Peter Merian-Weg 12
CH-4002 Basel, Switzerland
Phone +41 (0)61 965 11 11
Fax +41 (0)61 965 11 01

Straumann USA

Straumann USA, LLC
60 Minuteman Road
Andover, MA 01810
Phone 800/448 8168
978/747 2500
Fax 978/747 2490
www.straumannusa.com

Straumann Canada

Straumann Canada Limited
3115 Harvester Road, Suite 100
Burlington, ON L7N 3N8
Phone 800/363 4024
905/319 2900
Fax 905/319 2911
www.straumann.ca