

TiUnite™ is a highly crystalline and phosphate enriched titanium oxide characterized by a microstructured surface with open pores in the low micrometer range¹. The TiUnite™ implant surface has repeatedly proven to give an enhanced bone response compared to machined implant surfaces²⁻⁸. Nobel Biocare has received FDA clearance to claim a more rapid bone formation and greater amount of bone in contact with the TiUnite™ surface during healing. The enhanced bone response to TiUnite™ results in faster and stronger osseointegration and, thereby, better maintenance of the implant stability compared to machined titanium implants. When placed in soft bone and immediately loaded, the enhanced osseointegration of Nobel Biocare TiUnite™ implants results in higher success rates compared to machined implants. These claims are supported by extensive research^{2, 9-29}.

In addition to the publications supporting the FDA-cleared claims for the TiUnite™ implant surface, more than twenty references are available, which cover the use of TiUnite™ implants in various clinical and preclinical situations, using different types of protocols, and with various follow-up times³⁰⁻⁵².

References

- ¹ Hall J, Lausmaa J. Properties of a new porous oxide surface on titanium implants. *Appl Osseointegration Res* 2000;1:5-8.
- ² Albrektsson T, Johansson C, Lundgren AK, Sul Y, Gottlow J. Experimental studies on oxidized implants. A histomorphometrical and biomechanical analysis. *Appl Osseointegration Res* 2000;1:21-24.
- ³ Degidi M, Petrone G, Iezzi G, Piatelli A. Histologic evaluation of a human immediately loaded titanium implant with a porous anodized surface. *Clin Implant Dent Relat Res* 2002;4:110-114.
- ⁴ Huang YH, Xiropaidis AV, Sorensen RG, Albandar JM, Hall J, Wikesjö UME. Bone formation at titanium porous oxide (TiUnite) oral implants in type IV bone. *Clin Oral Impl Res* 2005;16:105-111.
- ⁵ Ivanoff C-J, Widmark G, Johansson C, Wennerberg A. Histologic evaluation of bone response to oxidized and turned titanium micro-implants in human jawbone. *Int J Oral Maxillofac Implants* 2003;3:341-348.
- ⁶ Rocci A, Martignoni M, Burgos P, Gottlow J, Sennerby L. Histology of retrieved immediately and early loaded oxidized implants. Light microscopic observations after 5 to 9 months of loading in the posterior mandible of 5 cases. *Clin Implant Dent Relat Res* 2003;12 (Suppl 1):88-98.
- ⁷ Schüpbach P, Glauser R, Rocci A, Martignoni M, Sennerby L, Lundgren AK, Gottlow J. The human bone-oxidized titanium implant interface: a microscopic, scanning electron microscopic, back-scatter electron microscopic, and energy-dispersive X-ray study of clinically retrieved implants. *Clin Implant Dent Relat Res* 2005;7 (Suppl 1):36-43.
- ⁸ Zechner W, Tangl S, Furst G, Tepper G, Thams U, Mailath G, Watzek G. Osseous healing characteristics of three different implant types. A histologic and histomorphometric study in mini-pigs. *Clin Oral Implants Res* 2003;14:150-157.
- ⁹ Glauser R, Portmann M, Ruhstaller P, Lundgren AK, Hämmerle C, Gottlow J. Stability measurements of immediately loaded machined and oxidized implants in the posterior maxilla. A comparative clinical study using resonance frequency analysis. *Appl Osseointegration Res* 2001;2:27-29.

- 10 Glauser R, Ruhstaller P, Windisch S, Zembic A, Lundgren AK, Gottlow J, Hämmerle CHF. Immediate occlusal loading of Brånemark System TiUnite implants placed in predominantly soft bone: 4-year results of a prospective clinical study. *Clin Implant Dent Relat Res* 2005;7 (Suppl1):52-59.
- 11 Henry P, Tan A, Allan B, Hall J, Johansson C. Removal torque comparison of TiUnite and turned implants in the Greyhound dog mandible. *Appl Osseointegration Res* 2000;1:15-17.
- 12 Rompen E, DaSilva D, Lundgren AK, Gottlow J, Sennerby L. Stability measurements of a double-threaded titanium implant design with turned or oxidized surfaces. An experimental resonance frequency analysis study in the dog mandible. *Appl Osseointegration Res* 2000;1:18-20.
- 13 Salata LA, Rasmusson L, Novaes AB, Papalexiou V, Sennerby L. The influence of anodic oxidation on implant integration and stability in bone defects. An RFA study in the dog mandible. *Appl Osseointegration Res* 2002;3:32-34.
- 14 Brechter M, Nilson H, Lundgren S. Oxidized titanium implants in reconstructive jaw surgery. *Clin Implant Dent Relat Res* 2005;7 (Suppl 1):83-87.
- 15 Calandriello R, Tomatis M. Simplified treatment of the atrophic posterior maxilla via immediate/early function and tilted implants: a prospective 1-year clinical study. *Clin Implant Dent Relat Res* 2005;7 (Suppl 1):1-12.
- 16 Maló P, Rangert B, Nobre M. All-on-4 immediate-function concept with Brånemark System implants for completely edentulous maxillae: a 1-year retrospective clinical study. *Clin Implant Relat Res* 2005;7 (Suppl 1):88-94.
- 17 Renouard F, Nisand D. Short implants in severely resorbed maxilla: a 2-year retrospective clinical study. *Clin Implant Relat Res* 2005;7 (Suppl 1):104-110.
- 18 Vanden Bogaerde L, Rangert B, Wendelhag I. Immediate/early function of Brånemark System TiUnite implants in fresh extraction sockets in the maxillae and posterior mandibles: an 18-month prospective clinical study. *Clin Implant Relat Res* 2005;7 (Suppl 1):121-131.
- 19 Villa R, Rangert B. Early loading of interforaminal implants immediately installed after extraction of teeth presenting endodontic and periodontal lesions. *Clin Implant Relat Res* 2005;7 (Suppl 1):28-35.
- 20 Balshi SF, Wolfinger GJ, Balshi TJ. A prospective study of immediate functional loading following the Teeth in a Day protocol: a case series of 55 consecutive edentulous maxillas. *Clin Implant Relat Res* 2005;7:24-31.
- 21 Calandriello R, Tomatis M. Immediate function of single implants using Brånemark System. Prospective one year report of final restorations. *Appl Osseointegration Res* 2004;4:32-40.
- 22 Calandriello R, Tomatis M, Vallone R, Rangert B, Gottlow J. Immediate occlusal loading of single molars using Brånemark System Wide Platform TiUnite implants: An interim report of a prospective, open-ended clinical multicenter study. *Clin Implant Relat Res* 2003;5 (Suppl 1):74-80.
- 23 Chiapasco M, Gatti C. Immediate loading of dental implants placed in revascularized fibula free flaps: a clinical report on 2 consecutive patients. *Int J Oral Maxillofac Implants* 2004;19:906-912.
- 24 da Cunha HA, Francischone CE, Filho HN, de Oliveira RC. A comparison between cutting torque and resonance frequency in the assessment of primary stability and final torque capacity of standard and TiUnite single-tooth implants under immediate load. *Int J Oral Maxillofac Implants* 2004;19:578-585.
- 25 Olsson M, Urde G, Andersen JB, Sennerby L. Early loading of maxillary fixed cross-arch dental prostheses supported by six or eight oxidized titanium implants: Results after 1 year of loading, case series. *Clin Implant Relat Res* 2003;5 (Suppl 1):81-87.
- 26 Östman PO, Hellman M, Sennerby L. Direct implant loading in the edentulous maxilla using a bone density-adapted surgical protocol and primary implant stability criteria for inclusion. *Clin Implant Dent Relat Res* 2005;7 (Suppl 1):60-69.
- 27 Rocci A, Martignoni M, Gottlow J. Immediate loading of Brånemark System with TiUnite and machined surfaces in the posterior mandible. A randomised, open-ended trial. *Clin Implant Dent Relat Res* 2003;12 (Suppl 1):57-63.
- 28 Vanden Bogaerde L, Pedretti G, Dellacasa P, Mozzati M, Rangert B. Early function of splinted implants in the maxillae and posterior mandibles using Brånemark System TiUnite implants: An 18-month prospective clinical multicenter study. *Clin Implant Dent Relat Res* 2003;5 (Suppl 1):21-28.
- 29 van Steenberghe D, Glauser R, Blombäck U, Andersson M, Schutyser F, Pettersson A, Wendelhag I. A computed tomographic scan-derived customized surgical template and fixed prosthesis for flapless surgery and immediate loading of implants in fully edentulous maxillae: a prospective multicenter study. *Clin Implant Dent Relat Res* 2005;7 (Suppl 1):111-120.
- 30 Attard N J, David LA, Zarb GA. Immediate loading of TiUnite implants with overdentures - A preliminary report. IADR 2003 Gothenburg, Abstract 1847.

- 31 Awillo K, Majewski P, Dijakiewicz M. Immediate loading of one-piece implants - Preliminary studies. EAO 2004. *Clin Oral Impl Res* 2004;15 (4): lii: abstract 182.
- 32 Becker W, Goldstein M, Becker BE, Sennerby L. Minimally invasive flapless implant surgery: a prospective multicenter study. *Clin Implant Dent Relat Res* 2005; 7 (Suppl 1): 21-27.
- 33 Chaussé L. Immediate loading of mandibular short implants: 24 cases at 42 months. EAO 2004. *Clin Oral Impl Res* 2004;15(4):lii:abstract 115.
- 34 Duyck J, Vrielink L, Lambrichts I, Abe Y, Schepers S, Politis C, Naert I. Bone response around immediately versus delayed loaded oral implants with ill-fitting prostheses. EAO 2004. *Clin Oral Impl Res* 2004;15(4):lii:abstract 108.
- 35 Friberg B, Dahlin C, Widmark G, Östman PO, Billström C. One-year results of a prospective multicenter study on Brånemark System implants with a TiUnite surface. *Clin Implant Dent Relat Res* 2005; 7 (Suppl 1): 70-75.
- 36 Glauser R, Schüpbach, Lundgren AK, Gottlow J, Hämmerle CHF. Machined and oxidized microimplants retrieved from humans: a comparison using histomorphometry and micro-computed tomography. EAO 2002. Abstract 64. *Clinical Oral Implants Research* 2002;13:xxv.
- 37 Glauser R, Schüpbach P, Gottlow J, Hämmerle CHF. Periimplant soft tissue barrier at experimental one-piece mini-implants with different surface topography in humans: a light-microscopic overview and histometric analysis. *Clin Implant Dent Relat Res* 2005; 7 (Suppl 1): 44-51.
- 38 Gottlow J, Henry P, Tan A, Allan B, Johansson C, Hall J. Biomechanical and histologic evaluation of the TiUnite and Osseotite implant surfaces in dogs. *Appl Osseointegration Res* 2000;1:28-30.
- 39 Gottlow J, Johansson C, Albrektsson T, Lundgren AK. Biomechanical and histologic evaluation of the TiUnite and Osseotite implant surfaces in rabbits after 6 weeks of healing. *Appl Osseointegration Res* 2000;1:25-27.
- 40 Hall J, Miranda-Burgos P, Sennerby L. Stimulation of directed bone growth at oxidized implants by macroscopic grooves: an in vivo study. *Clin Implant Dent Relat Res* 2005; 7 (Suppl 1): 76-82.
- 41 Knobloch L, Larsen PA, Rashid B, Carr AB Six-month performance of implants with oxidized and machined surfaces restored at 2, 4, and 6 weeks postimplantation in adult beagle dogs. *Int J Oral Maxillofac Implants* 2004;19:350-356.
- 42 Kyungsoo H, Sungam C, SangHwan K. Comparison of removal torques between anodizing implant and laser treated implant inserted in the rabbit femoral metaphysis. AO 2004 Poster #112.
- 43 Molly L, Quirynen M, van Steenberghe D. Influence of implant geometry and surface characteristics on primary stability and osseointegration. EAO 2004. *Clin Oral Impl Res* 2004;15(4):lii:abstract 89.
- 44 Rocci A, Gottlow J. Esthetic outcome of immediately loaded scalloped implants placed in extraction sites using flapless surgery. A 6 month report of 4 cases. *Appl Osseointegration Res* 2004;4:55-62.
- 45 Schüpbach P, Glauser R, Guggenheim B. Evaluation of in situ biofilms on machined, acid-etched and oxidized titanium surfaces. EAO 2004. *Clin Oral Impl Res* 2004;15(4):li:abstract 82.
- 46 Schüpbach P, Glauser R, Lundgren AK, Gottlow J, Hämmerle CHF. Evaluation of the bone tissue around implants by a new microtomographic technique. IADR Abstract. *J Dent Res* 2002;82.
- 47 Sennerby L, Miyamoto I. Insertion torque and RFA analysis of TiUnite and SLA implants. A study in rabbit. *Appl Osseointegration Res* 2000;1:31-33.
- 48 Suketa N, Sawase T, Tanaka Y, Kjellin P, Wennerberg A, Albrektsson T, Atsuta M. Photocatalytic reaction on TiUnite surfaces. EAO 2004. *Clin Oral Impl Res* 2004;15(4):lii:abstract 127.
- 49 Tomatis M, Calandriello R, Rangert B. Immediate loading of Brånemark implants with two different surfaces. EAO 2002. Abstract 78. *Clinical Oral Implants Research* 2002;13(4):abstract 78.
- 50 Wöhrle P.S, Jovanovic SA A biological approach to predictable natural implant esthetics. *Appl Osseointegration Res* 2004;4:49-54.
- 51 Xiropaidis A V, Qahash, W H Lim, R H Shanaman, R G Sorensen, J M Wozney, U M Wikesjö, J Hall. Bone-implant contact at calcium phosphate and titanium porous oxide (TiUnite[®]) modified dental implants. IADR Abstract. *J Dent Res, Spec iss A* 2002;81. p 489. #4001.
- 52 Zechner W, Tangl S, Tepper G, Furst G, Bernhart T, Haas R, Mailath G, Watzek G. Influence of platelet-rich plasma on osseous healing of dental implants: A histologic and histomorphometric study in minipigs. *Int J Oral Maxillofac Implants* 2003;18:15-22.