



Scientific Review for Straumann® Roxolid® SLActive® Implants.

HIGHER SECURITY IN ALL INDICATIONS

Roxolid® is a unique implant material combining both excellent biocompatibility and high mechanical strength. Roxolid® is a metal alloy composed of ~15% zirconium and ~85% titanium which leads to an increased mechanical resistance compared to pure titanium. A higher mechanical resistance of titanium-zirconium alloys compared to pure titanium has been reported by **Kobayashi et al. 1995**. Roxolid® Implants have an up to 40 % higher fatigue strength than comparable titanium implants (**Bernhard et al. 2009**). In addition, it has been shown that titanium-zirconium alloys have a better biocompatibility than titanium (**Ikarashi et al. 2005**).

Today, dentists and their patients expect not only a successful dental implant treatment but also a short and predictable healing time. Straumann® SLActive® is a chemically modified hydrophilic surface. In preclinical studies, it was shown that the osseointegration process of the SLActive® surface is accelerated compared to the SLA® surface (**Buser et al. 2004, Schwarz et al. 2007**). A shorter healing time does not only allow early implant loading but also increases the security by shortening the critical healing phase. Beyond that, Roxolid® Implants with the SLActive® surface showed osseointegration properties which were at least as good or even superior to those of titanium implants with the SLActive® surface (**Gottlow et al. 2012, Bo Wen et al. 2013**).

Also in human studies, it was proven that the osseointegration process is accelerated for implants with the SLActive® surface (**Oates et al. 2007, Lang et al. 2011**). Furthermore, it was demonstrated that implants with the SLActive® surface can successfully be used in immediate and early treatment protocols without compromising on performance or predictability of the implant therapy (**Nicolau et al. 2013, Bornstein et al. 2010, Buser et al. 2013**). These conclusions are supported by the preclinical findings of a shortened healing phase which indicates an increased security during this critical phase of implant therapy.

Further clinical studies showed that Roxolid® SLActive® Implants are equally effective as titanium implants (**Barter et al. 2012, Al-Nawas et al. 2012, Freiburger et al. 2012**). In these studies Roxolid® SLActive® Implants reached success and survival rates of 97 % or higher after two years – similar as reported for titanium implants. Also crestal bone level changes of less than 0.2 mm per year following the year after implant placement have been documented for Roxolid® SLActive® Implants.

PREDICTABLE TREATMENT SUCCESS EVEN IN CHALLENGING CASES

Many patients have difficult health conditions which could compromise the treatment outcome of the implant therapy. Especially in challenging indications, the use of an implant system which is clinically tested and for which the performance is documented in scientific literature is mandatory to minimize the risk of treatment failure. Straumann® Roxolid® SLActive® Implants have been tested in very challenging indications and successful treatment outcomes were documented. Clinical studies have been performed in the following challenging clinical situations:

- Implant placement in the horizontally augmented maxillary sinus, 97 % survival rate after one year (**Lindgren et al. 2010 et al.**)
- Dehiscence defects after implant placement, 100 % survival rate after one year (**Van Assche et al. 2013**)
- Early implant placement in the posterior maxilla, 100 % survival rate after one year (**Roccuzzo & Wilson 2009**)
- Treatment of irradiated patients in the head and neck area, 100 % survival rate after 14 months (**Heberer et al. 2011**)
- Treatment of patients with poorly controlled type II diabetes, 98 % survival rate after 16 weeks (**Khandelwal, et al. 2013**)
- Immediate loading of overdentures supported by two implants, 99 % survival rate after up to 40 months (**Stoker et al. 2011**)

- Rehabilitation of atrophic maxilla supporting an overdenture, 100 % survival rate after up to 16 months (Cordaro et al. 2013)

These studies impressively document that SLActive® Implants can also successfully be placed in very challenging indications and patients with difficult health conditions.

PRACTICE DIFFERENTIATOR OFFERING NEW TREATMENT POSSIBILITIES

Many clinicians routinely treat patients with a limited quantity of crestal jaw bone. In these situations, implants with a regular diameter or length can only be placed if reconstructive or regenerative techniques will be applied. These techniques can be very invasive for the patient as well as time consuming and expensive. Above all, there is also the risk that these treatments fail. Smaller-sized implants could overcome the need of reconstructive or regenerative therapies and are therefore an attractive alternative. Benic et al. 2013 compared Ø 3.3 mm Roxolid® Implants to Ø 4.1 mm titanium implants. In this study, it has been found that both implants performed equally successful, reaching 100 % success and survival rates after one year. Chiapasco et al. 2012 used Ø 3.3 mm Roxolid® Im-

plants in the lateral posterior areas as an alternative treatment option to bone regeneration or reconstructions. In the study, 100 % success and survival rates were found after up to 19 months. In a non-interventional study, which was performed in 40 centers in 7 countries, 603 Roxolid® Implants were placed in 357 patients (Freiberger et al. 2012). The study reported a survival rate of 98 % and a success rate of 97 % after two years. Clinicians also documented that for 54 % of the placed implants a bone augmentation procedure could be avoided by using Ø 3.3 mm Roxolid® Implants. Very short SLActive® Implants were used in a study by Slotte et al. 2012 in patients with atrophied mandibular ridges. In this study, 4 mm Straumann® Standard Plus Short Implants were used to avoid vertical augmentation procedures and an implant survival rate of 94 % after five years was documented. Roxolid® Implants offer a higher tensile strength compared to titanium implants and therefore can be used also in challenging indications. The hydrophilic SLActive® surface enhances the healing process compared to hydrophobic surfaces. The accelerated osseointegration process makes the implant also an excellent treatment option for medically compromised patients.

REFERENCES

- Al-Nawas B, Brägger U, Meijer HJ, Naert I, Persson R, Perucchi A, Quirynen M, Raghoobar GM, Reichert TE, Romeo E, Santing HJ, Schimmel M, Storelli S, ten Bruggenkate C, Vande-kerckhove B, Wagner W, Wismeijer D, Müller F.: A double-blind randomized controlled trial (RCT) of Titanium-13Zirconium versus Titanium Grade IV small-diameter bone level implants in edentulous mandibles--results from a 1-year observation period. *Clin Implant Dent Relat Res.* 2012 Dec;14(6):896-904. Barter S, Stone P, Brägger U.: A pilot study to evaluate the success and survival rate of titanium-zirconium implants in partially edentulous patients: results after 24 months of follow-up. *Clin Oral Implants Res.* 2012 Jul;23(7):873-81. Benic GI, Gallucci GO, Mokti M, Hammerle CHF, Weber H-P, Jung RE. Titanium-zirconium narrow-diameter versus titanium regular-diameter implants for anterior and premolar single crowns: 1-year results of a randomized controlled clinical study. *J Clin Periodontol* 2013; Bernhard N, Berner S, de Wild M, Wieland M: The binary TiZr Alloy - a newly developed Ti alloy for the use in dental implants. *Forum Implantol.* 2009, 5, 30-39. Bornstein MM, Wittneben JG, Brägger U, Buser D.: Early loading at 21 days of non-submerged titanium implants with a chemically modified sandblasted and acid-etched surface: 3-year results of a prospective study in the posterior mandible. *J Periodontol.* 2010 Jun;81(6):809-18. Buser D, Broggini N, Wieland M, Schenk RK, Denzer AJ, Cochran DL, Hoffmann B, Lussi A, Steinemann SG: Enhanced bone apposition to a chemically modified SLA titanium surface. *J Dent Res.* 2004 Jul;83(7):529-33. Buser D, Chappuis V, Kuchler U, Bornstein MM, Wittneben JG, Buser R, Cavusoglu Y, Belser UC. Long-term Stability of Early Implant Placement with Contour Augmentation. *J Dent Res.* 2013 Oct 24 [Epub ahead of print]. Chiapasco M, Casentini P, Zaniboni M, Corsi E, Anello T. Titanium-zirconium alloy narrow-diameter implants (Straumann Roxolid®) for the rehabilitation of horizontally deficient edentulous ridges: respective study on 18 consecutive patients. *Clin Oral Implants Res.* 2012 Oct;23(10):1136-41. Cordaro L, Torsello F, Mirisola di Torresanto V, Baricevic M.: Rehabilitation of an edentulous atrophic maxilla with four unsplinted narrow diameter titanium-zirconium implants supporting an overdenture. *Quintessence Int.* 2013 Jan;44(1):37-43. Freiberger P, Al-Nawas B.: Non-interventional Study on Success and Survival of TiZr Implants. *EO 2012 Copenhagen*; 305 Posters - Implant Therapy Outcomes, Surgical Aspects. Gottlow J, Dard M, Kjellson F, Obrecht M, Sennerby L.: Evaluation of a new titanium-zirconium dental implant: a biomechanical and histological comparative study in the mini pig. *Clin Implant Dent Relat Res.* 2012 Aug;14(4):538-45. Heberer S, Kilic S, Hossamo J, Raguse JD, Nelson K.: Rehabilitation of irradiated patients with modified and conventional sandblasted acid-etched implants: preliminary results of a split-mouth study. *Clin Oral Implants Res.* 2011 May;22(5):546-51. Ikarashi Y, Toyoda K, Kobayashi E, Doi H, Yoneyama T, Hamanaka H, Tsuchiya: Improved biocompatibility of Titanium-Zirconium (Ti-Zr) alloy: Tissue reaction and sensitization to Ti-Zr alloy compared with pure Ti and Zr in rat implantation study. *Materials Transaction*, 46, 10, 2260-2267. Khandelwal N, Oates TW, Vargas A, Alexander PP, Schoolfield JD, Alex McMahan C.: Conventional SLA and chemically modified SLA implants in patients with poorly controlled type 2 diabetes mellitus--a randomized controlled trial. *Clin Oral Implants Res.* 2013 Jan;24(1):13-9. Kobayashi E, Matsumoto S, Doi H, Yoneyama T, Hamanaka H. Mechanical properties of the binary titanium-zirconium alloys and their potential for biomedical materials. *J Biomed Mater Res.* 1995 Aug;29(8):943-50. Lang NP, Salvi GE, Huynh-Ba G, Ivanovski S, Donos N, Bosshardt DD.: Early osseointegration to hydrophilic and hydrophobic implant surfaces in humans. *Clin Oral Implants Res.* 2011 Apr;22(4):349-56. Lindgren C, Mordenfeld A, Hallman M.: A prospective 1-year clinical and radiographic study of implants placed after maxillary sinus floor augmentation with synthetic biphasic calcium phosphate or deproteinized bovine bone. *Clin Implant Dent Relat Res.* 2012 Mar;14(1):41-50. doi: 10.1111/j.1708-8208.2010.00224.x. Epub 2010 May 11. Nicolau P, Korostoff J, Ganeles J, Jackowski J, Krafft T, Neves M, Divi J, Rasse M, Guerra F, Fischer K.: Immediate and Early Loading of Chemically Modified Implants in Posterior Jaws: 3-Year Results from a Prospective Randomized Multicenter Study. *Clin Implant Dent Relat Res.* 2013 Aug;15(4):600-612. Oates TW, Valderrama P, Bischof M, Nedir R, Jones A, Simpson J, Toutenburg H, Cochran DL: Enhanced implant stability with a chemically modified SLA surface: a randomized pilot study. *Int J Oral Maxillofac Implants.* 2007 Sep-Oct;22(5):755-60. Roccuzzo M, Wilson TG Jr.: A prospective study of 3 weeks' loading of chemically modified titanium implants in the maxillary molar region: 1-year results. *Int J Oral Maxillofac Implants.* 2009 Jan-Feb;24(1):65-72. Schwarz F, Ferrari D, Herten M, Mihatovic I, Wieland M, Sager M, Becker J.: Effects of surface hydrophilicity and microtopography on early stages of soft and hard tissue integration at non-submerged titanium implants: an immunohistochemical study in dogs. *J Periodontol.* 2007 Nov;78(11):2171-84. Slotte Christen et al, Four-mm implants supporting fixed partial dentures in the posterior mandible. 5-year results from a multicenter study. Presented at the 20th Annual Scientific Meeting of the European Association of Osseointegration, 10-13 October 2012, Copenhagen, Denmark. Stoker GT, Wismeijer D.: Immediate loading of two implants with a mandibular implant-retained overdenture: a new treatment protocol. *Clin Implant Dent Relat Res.* 2011 Dec;13(4):255-61. Van Assche N, Michels S, Naert I, Quirynen M.: Randomized Controlled Trial to Compare Two Bone Substitutes in the Treatment of Bony Dehiscence. *Clin Implant Dent Relat Res.* 2013 Aug;15(4):558-568. Wen B, Zhu F, Li Z, Zhang P, Lin X, Dard M.: The osseointegration behavior of titanium-zirconium implants in ovariectomized rabbits. *Clin Oral Implants Res.* 2013 Feb 21. Pictures frontpage: ©Empa



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