

# Innovation

## Global excellence, focused on customer needs and commercial success



Creating opportunities in the specialist segment: In Straumann's Peer-to-Peer Program, experts share their knowledge and techniques with dental professionals.



Surgical drill templates for placing dental implants with precision are produced using 3D printing technology.

Straumann was a pioneering force in implant dentistry and still is a leading innovator in the field. Our history is full of developments that have defined industry standards and created opportunities for dental professionals, patients and the company itself. We continue to be a leading contributor to research in the field and invest to ensure a constant flow of projects in our pipeline.

### MEANINGFUL INNOVATION

For us, meaningful innovation is the successful commercialization of an idea or combination of ideas. One example of this, introduced in 2016, is our 'smile-in-a-box' solution which delivers all the components needed for implant surgery and restoration at the same time.





The practitioner receives a customized drill-guide, prosthesis, implants, drills, abutments, etc. prior to surgery,

which means the patient can be treated in a single session and leave the practice with functioning new teeth. The concept, introduced at two peer-to-peer events (see pp. 26, 30), relies on careful pre-planning and saves time, cost and inconvenience.

Innovative technology was evident throughout the event: Straumann's interconnected digital workflow was used to plan the surgery, manufacture the guides, produce the prosthesis, order the components, manage the patient information, and even schedule the first check-ups.

The drill guides were produced by 3D printing for precision and cost effectiveness; Roxolid BLT SLActive implants were used for high strength, immediate stability and fast osseointegration; Emdogain was applied to

## A STOCKED INNOVATION PIPELINE

	Project	Key benefit target	Introduction/ rollout
	Smaller implants	Less invasive procedures if guided bone regeneration (GBR) can be avoided	2017
	Modular Surgical Cassette	Enhanced surgical flexibility and lower entry barrier	2017
	Single-use instruments	Complete portfolio of instruments for single use	2017
	PURE 2 ceramic implant	High-end esthetics, increased prosthetic flexibility	2017+
	Simplified Guided Surgery	Increasing confidence when placing implants	2017+
	Mini-Implants	Cost effective edentulous procedures	2018
	New Bone Level implant system	Implant system for immediate procedures	2018
	New Tissue Level implants	Straumann heritage revisited	2019
	Variobase prosthetics	Enable cost-effective restorations for the esthetic zone	2017
	New material	Direct venerable CAD/CAM abutments	2017
	Colored prosthetics	Naturally colored abutments for patients with thin gingiva	2017
	New material	Multilayered ceramic material for improved esthetics	2017
	etkon iDent	High quality prosthetic compatible to major brands	2017
	Angulated solution	Allowing for screw-retained restorations in all indications	2017+
	Integrated workflow	Digital workflow support for immediate tooth replacement	2017
	Intra-oral scanner	Further portfolio development of our integrated digital impression system	2017
	CARES milling system	New integrated in-house milling systems and additive manufacturing options	2017
	CARES printing system	Additive manufacturing systems (3D printing)	2017
	Emdogain	New indications	2017+
	Osteogain	Bone enhancement	2017+

Highlights from Straumann's development pipeline. Introduction/rollout dates may be subject to positive clinical results and regulatory clearances, and barring unforeseen circumstances.

reduce swelling and support wound healing (see p.37); Pro Arch screw-retained prosthetics or high-tech Novaloc retention devices (see p.34 f.) – launched in midyear – were used.

Even the marketing/education approach was innovative, with peer-to-peer mentoring for the surgeons and prosthodontists, and full documentation to record and perfect the technique.

All of these innovations were brought together to treat patients in general daily practice conditions.

### INNOVATION – INSPIRED BY AND TAILORED FOR CUSTOMERS

Over time, product, process and solution innovations have proven to be the key drivers of Straumann's global success. The inspiration to turn a multitude of ideas into marketable solutions that address increasing consumer needs comes from various sources:

- The constant internal exchange of ideas between the Straumann Group companies in the areas of product management, production, and R&D;
- Continuous market screening, including scouting at dental congresses/trade fairs and observing other industries for insight into new trends and developments;
- The Straumann 'Idea Portal', a global, web-based platform invites researchers, clinicians, clients, employees and other stakeholders to share innovative ideas

## SELECTED KEY PUBLICATIONS ON STRAUMANN'S PRODUCTS IN 2016

Authors	Study Title	Product	Journal	Conclusion
Gahlert M, Kniha H, Weingart D, Schild S, Gellrich NC, Bormann KH	A prospective clinical study to evaluate the performance of zirconium dioxide dental implants in single-tooth gaps.	PURE	Clin Oral Implants Res. 2016 Dec; 27(12):e176-e184.	Monotype ceramic implants can achieve clinical outcomes comparable to published outcomes of equivalent titanium implants.
Monzavi M, Noubissi S, Nowzari H	The impact of in vitro accelerated aging, approximating 30 and 60 years in vivo, on commercially available zirconia dental implants.	PURE	Clin Implant Dent Relat Res. 2016 Nov 9.	Straumann PURE implant performed as well as, or better than the evaluated competitors, especially at longer time points.
Liñares A, Grize L, Muñoz F, Pippenger BE, Dard M, Domken O, Blanco-Carrión J	Histological assessment of hard and soft tissues surrounding a novel ceramic implant: a pilot study in the minipig.	PURE	J Clin Periodontol. 2016 Jun;43(6):538-46.	The epithelial attachment favors the PURE ceramic implant over the titanium one.
Derks J, Schaller D, Håkansson J, Wennström JL, Tomasi C, Berglundh T	Effectiveness of implant therapy analyzed in a Swedish population: Prevalence of peri-implantitis.	Tissue Level implant	J Dent Res. 2016 Jan;95(1):43-9.	The probability of being diagnosed with peri-implantitis 9y after implant therapy was lowest with Straumann TL SLA implants.
Herrmann J, Hentschel A, Glauche I, Vollmer A, Schlegel KA, Lutz R	Implant survival and patient satisfaction of reduced diameter implants made from a titanium-zirconium alloy: A retrospective cohort study with 550 implants in 311 patients.	Roxolid/ SLActive	J Craniomaxillofac Surg. 2016 Sep 23.	Implant survival of 97.4% after 2 years for Roxolid 3.3mm implants.
Medvedev AE, Molotnikov A, Lapovok R, Zeller R, Berner S, Habersetzer P, Dalla Torre F	Microstructure and mechanical properties of Ti-15Zr alloy used as dental implant material.	Roxolid	J Mech Behav Biomed Mater. 2016 Sep;62:384-98.	Enhanced fatigue performance of Roxolid over Titanium.
Calvo-Guirado JL, López Torres JA, Dard M, Javed F, Pérez-Albacete Martínez C, Maté Sánchez de Val JE	Evaluation of extra short 4-mm implants in mandibular edentulous patients with reduced bone height in comparison with standard implants: 12-month results.	4mm implant	Clin Oral Implants Res. 2016 Jul;27(7):867-874.	Implant survival of 97.5% after 1 year for Roxolid extra short 4mm long implants.
Stavropoulos A, Cochran D, Obrecht M, Pippenger BE, Dard M	Effect of osteotomy preparation on osseointegration of immediately loaded, tapered dental implants.	Bone Level Tapered implant	Adv Dent Res. 2016 Mar;28(1):34-41.	Increased primary stability of Bone Level tapered implant in underprepared osteotomies.
Piano S, Romeo E, Sbricoli L, Pisoni G, Cea N, Lops D	Simplified procedure for the immediate loading of a complete fixed prosthesis supported by four implants in the maxillary jaw: a 2-year prospective study.	Pro Arch	Clin Oral Implants Res. 2016 Dec;27(12):e154-e160.	Immediate loading of four implants positioned anteriorly to the maxillary sinus could be a reliable treatment procedure to support fixed complete restorations.
Dard M, Shiota M, Sanda M, Yajima Y, Sekine H, Kasugai S	A randomized, 12-month controlled trial to evaluate non-inferiority of early compared to conventional loading of modSLA implants in single tooth gaps.	SLActive	Int J Implant Dent. 2016 Dec;2(1):10.	Early loading of SLActive implants in single tooth gaps in molar regions is non-inferior to conventional loading approach in terms of crestal bone level change in short follow-up period.
Alayan J, Vaquette C, Saifzadeh S, Huttmacher D, Ivanovski S	Comparison of early osseointegration of SLA and SLActive implants in maxillary sinus augmentation: a pilot study.	SLActive	Clin Oral Implants Res. 2016 Sep 29.	SLActive performs better than SLA with regards to percentage of bone to implant contact and composition of the tissue surrounding the implant.
French D, Cochran DL, Ofec R	Retrospective cohort study of 4591 Straumann implants placed in 2060 patients in private practice with up to 10-year follow-up: the relationship between crestal bone level and soft tissue condition.	SLA	Int J Oral Maxillofac Implant. 2016 Nov/Dec; 31(6):e168-e178.	Long term data with a high number of implants showing outstanding performance.
Mattheos N, Li X, Zampelis A, Ma L, Janda M.	Investigating the micromorphological differences of the implant-abutment junction and their clinical implications: a pilot study.	Original Straumann implant-abutment connection	Clin Oral Implants Res. 2016 Nov;27(11):e134-e143.	Non-original abutments present morphological differences from the original ones.
Maymon-Gil T, Weinberg E, Nencovsky C, Weinreb M	Enamel Matrix Derivative promotes healing of a surgical wound in the rat oral mucosa.	Emdogain	Clin Oral Investig. 2016 Apr; 20(3):589-95.	EMD improves incisional wound healing by promoting formation of blood vessels and collagen fibers in connective tissue.

with us. Out of the hundred ideas submitted and evaluated in 2016, a handful have potential for further development;

- Interaction with customers is an important source of innovation. Besides individual customer visits, we organize global, national and regional meetings to understand professional, business, and market needs and to discuss existing and potential innovations. In 2016, 130 participants from 20 nations attended these meetings.

## PRECLINICAL AND CLINICAL RESEARCH SUCCESS BASED ON SCIENCE

It is essential that all products destined for patients are appropriately tested for biocompatibility, stability, and strength, and to ensure that the properties developed in the laboratory can be reproduced on a commercial scale. Technologies, materials and designs that demonstrate the necessary characteristics are studied *in vivo*, together with the surgical techniques in appropriate cases.

Straumann products and technologies are thoroughly evaluated in a defined global clinical study program, which includes single- and multi-center studies, as well as investigator-initiated studies. Proposals for the latter are carefully screened and may be supported in various ways. Clinical investigation can further include large post-market surveillance and non-interventional studies covering a range of patients and indications treated in daily practice conditions. Very few implant companies perform clinical studies on this scale. The results provide clear reasons why our customers trust in Straumann products.

## DOZENS OF PUBLICATIONS

In 2016, an impressive body of scientific evidence on our products was published in peer-reviewed journals. There were at least 77 publications, including results from our own programs, ITI-funded studies (p. 103) and independent research. These are some of the highlights:

- A study published by French et al. reported outstanding performance of almost 4 600 Straumann implants in more than 2 000 patients. Many of the implants had been functioning for more than ten years and bone loss was minimal (less than half a millimeter on average) even after this time.
- Following their publication in 2015 on relative risk for implant loss, Derks et al. published the second part of

their study in early 2016. Looking at periimplantitis, which can lead to implant loss, the follow-up publication also showed excellent results for Straumann.

- 2016 also saw the first multicentre clinical data on Straumann PURE ceramic implants, published by Gahlert et al.; reporting a success and survival rate of 97.6% as well as very stable bone level after one year in function. These high rates are comparable to the excellent performance of titanium implants.

An overview of selected key studies published in 2016 is presented in the table on p. 47. More details on these and other relevant publications on Straumann products can be found at <http://www.straumann.com/en/home/science>

## OUTLOOK

Customer needs and commercial success are the driving forces of Straumann's innovation process. Straumann continues to rigorously test its products under scientific conditions in order to provide customers and patients with reliability, quality and peace of mind. With this in mind we will continue to invest significantly in research and development for more life-long smiles worldwide.