Roxolid®: a material for new strategies in oral implantology

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30 years of progress behind us

Can we still talk about dogma in oral implantology? In the last 30 years, implants have never stopped progressing. Many small revolutions have occurred that changed implant parameters, such as macro- and micro-roughness, implant diameters, implant lengths, or combination with bone volume augmentation techniques, etc. This progress has allowed for a good imitation of natural teeth, and patients now want to obtain the ideal treatment without undergoing a complex surgical procedure that may involve an autogenous bone graft, sinus lift, or soft tissue grafts.

The quest for the ideal material

Patient quality of life with regard to oral health during and after treatment was evaluated. The simplest treatments, i.e. without autogeneous bone graft, sinus lift or soft tissue graft, produce higher patient acceptance scores. The surgical procedures have been simplified over the last 10 years. The osseointegration time reduction to 4 weeks and the reliability of immediate loading have overshadowed the necessity of wearing an uncomfortable temporary denture. Moreover, the optimization of implant design and the introduction of the platform switching concept combined with smaller diameter implants, has reduced the need for bone augmentation. Many firms have focused their research toward the discovery of the ideal material, which is highly biocompatible and fracture resistant. Titanium alloys are commonly used in implantology.

For instance Ti6Al4V alloy exhibits higher mechanical performance than Ti Grade 4; however surface treatments do not allow the same micro- and macro-roughness as Ti Grade 4 that is beneficial for osseointegration and bone metabolism. The need for a material that combines both high strength and excellent osseointegration led to the development of new alloys as in the case of Roxolid®.

Roxolid® – an innovation with promising results

Roxolid®, which has a metallic gray appearance, is a combination of zirconium and titanium (TiZr) and is reported to have excellent biocompatibility and higher mechanical strength than Ti Gr 4. Additionally, preclinical tests showing

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Table 1: Example of clinical cases successfully treated with small diameter implants Roxolid 3.3 mm by the authors.

Implant used	Prosthetic Reconstruction
	Maxillary incisors and premolars FPD framework support Full arch or sectorial immediate loading Overdenture attachments
	Wide emergence profiles Zirconia or titanium anatomic abutment Immediate loading with 25° angulated abutments

higher cellular adhesion than Ti alloys and a survival rate of 98.8% after two years clinical studies are promising. The Roxolid surface always consists of Straumann SLActive®, which is beneficial for osseointegration, as explained in the following section.

SLActive®: surface properties as a crucial factor

The quality of osseointegration seems to be related to the ability of osteoblast cells to couple rapidly with the implant surface. The effectiveness of implant surfaces is multifactorial and no longer simply depends on sandblasting and/or etching. Each step in the industrial process, such as the choice of blasting particles, type and titration of acids, frequency of quality controls and implant packaging, has to be mastered. Only this rigor and prior scientific investigations lead to an improved surface chemistry and reproducible clinical results. The hydrophilic SLActive® surface with micro- and macroroughness topography allows early adhesion of the cells necessary for new bone formation. Bone formation is initiated immediately, resulting in earlier secondary stability and consequently to a reduction of the risk of failure to just 2–4 weeks. A preclinical study reported that the SLActive® surface achieves about 20 % increase of bone to implant contact (BIC) formation two weeks after implantation when compared to SLA surface. These histological results correspond to an increased removal torque in the same timeframes, which underlines the good absorption of the implant in the bone.

Expanding the applications for small diameter implants

The use of a 3.3-mm implant helps in emergency needs in a strategic site. The opportunity to perform surgery that is less aggressive will expand the recommendations for smaller diameter implants. Table 1 lists some clinical cases and indications that have been positively treated by the authors (see table 1).

Patients who consider themselves too old or whose anxiety paralyzes them at the thought of undergoing a "major procedure" may agree to the implant solution. This therapeutic choice of using small-diameter implants will no longer be a second choice after conventional treatments.

Roxolid enables a new way of thinking about implantology

It appears obvious that an implant is more stable in larger bone volume. The biology necessary for good implant integration depends on cortical and cancellous bone architecture. All too often, clinical bone conditions force borderline use of bone volume. This standard implant placement approach should change for smaller size implants that allow preservation of a larger bone volume around them and open up more treatment options with small diameter implants. This attractive effect needs to be validated by other prospective studies, to again change the dogmas of oral implantology. The following clinical case gives one detailed example of Roxolid's potential.

Clinical Case Report

The use of Roxolid® implants for tooth replacement in hypodontic patients

Anamnesis

A 27-year-old woman with 4 temporary teeth presenting no replacement teeth consulted a professional. She complained of functional difficulty with mastication and a cosmetic problem with regard to the shape and color of her temporary teeth. To compensate for the missing teeth 12, 13, 22 and 23, the patient asked for a cosmetic and permanent fixed rehabilitation. As far as possible, she wanted to avoid a partial removable denture during the osseointegration period and combination with orthodontic treatment. The patient reported no diseases that could contraindicate oral implantology. The facial physical exam showed good facial symmetry. When she smiled, it was easy to see the gingival scalloping. On oral exam, no gingival inflammation was found, and her hygiene was excellent. Study of the neck line showed a curve disrupted by short teeth. The smile had become disharmonious, as the free edges had become abraded and the enamel stained. The curve of the smile needed to be adjusted (Figs. 1 – 3). Palpation of the alveolar processes showed good thickness at the neck of the teeth, but they appeared to become thinner rapidly when the apical region was tested. At each site, the available mesiodistal space from the distal sides of the central incisors to the mesial sides of the first premolars was 11.5 mm. A panoramic x-ray and a three-dimensional cone beam x-ray (3Ds Planmeca) were performed. Analysis of the sagittal slices confirmed low apical volume. Digital modelling of the positioning of a 4.1-mm diameter implant showed that it was incompatible with the prosthetic axis without invasion of the vestibular cortical bone. The use of a 3.3-mm diameter implant combined a prosthetic axis that retains the available bone volume. The analysis of the panoramic reconstruction made from the 3D image allowed precise measurement of the available mesiodistal space. There was 11.5 mm available on each site to rehabilitate (Fig. 4).

Considerations and treatment plan

The reference publications on implant positioning propose a tooth-implant distance of 1.5 mm and an implant-implant distance of 3 mm. The use of two 3.3-mm implants requires a minimum space of 12.6 mm. The missing millimeter may be detrimental in preserving the inter-implant bone papilla. Because the bone biology could not be respected, the gingival papilla would not be stable over time. With two

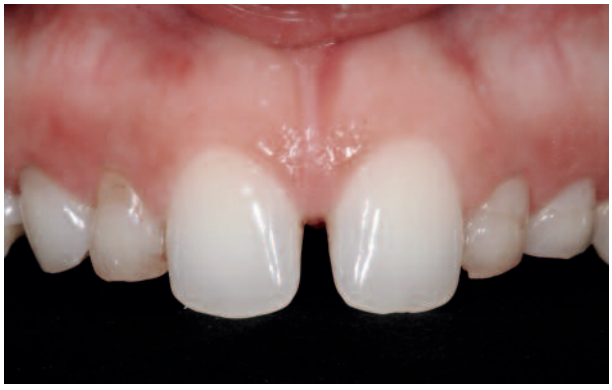
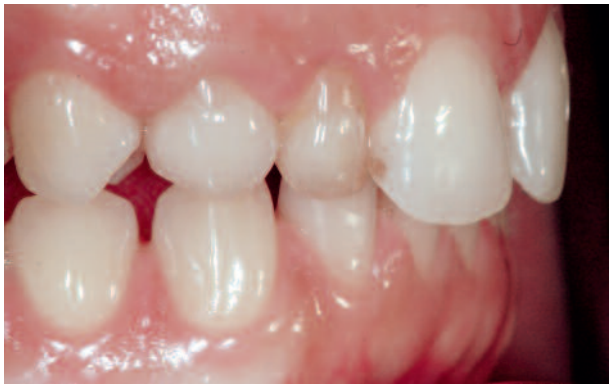


Figure 1



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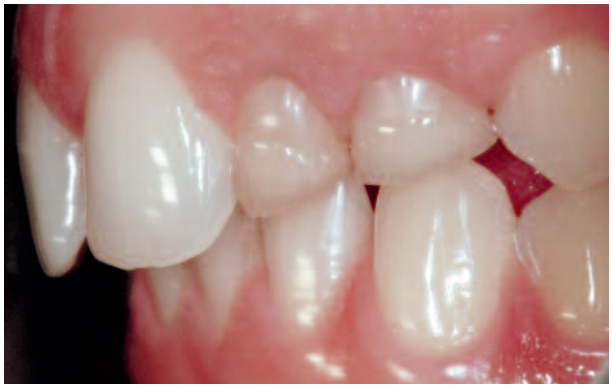

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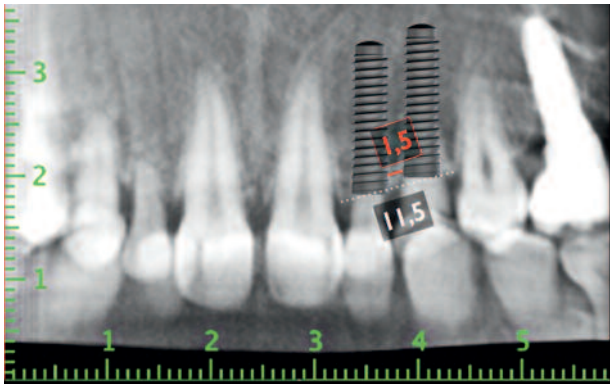

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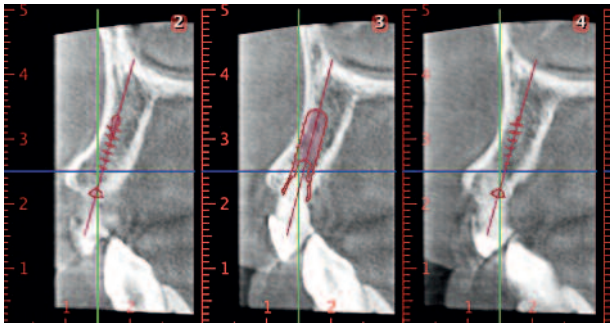

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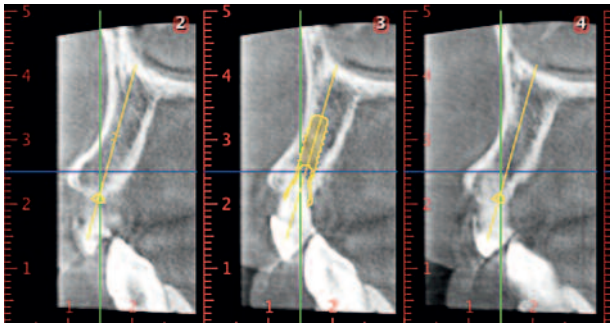

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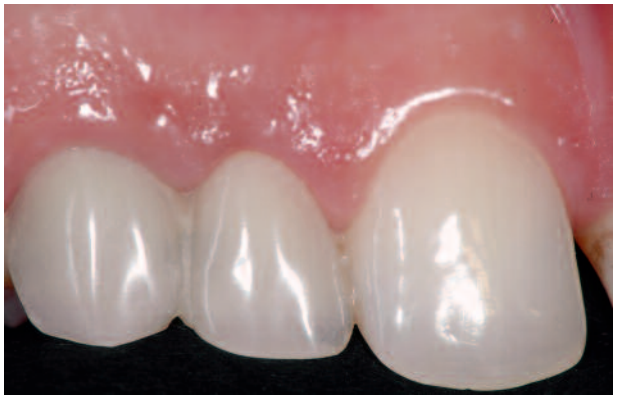

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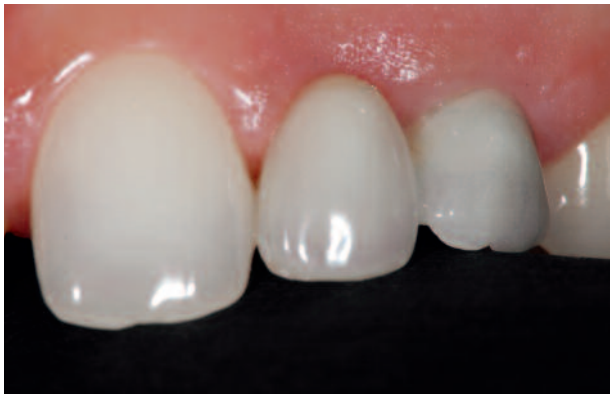

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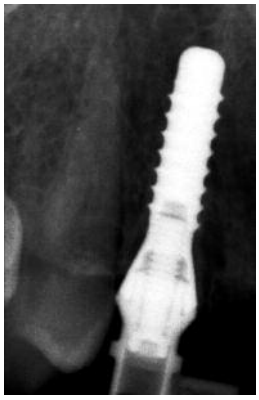

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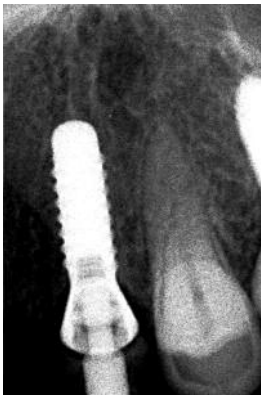

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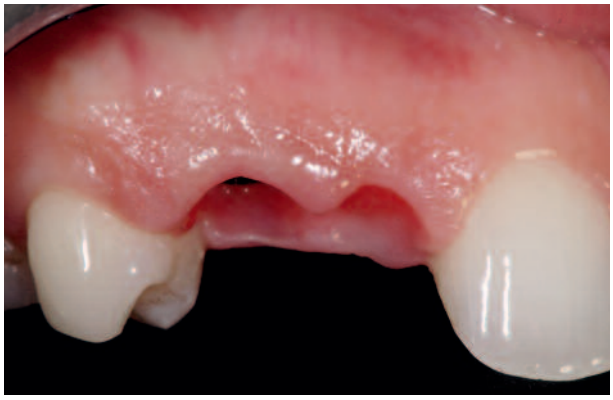

Figure 11

implants to replace two teeth, the cosmetics could not be guaranteed, bone loss would appear and a pocket could be created between two implants that are too close. Faced with this clinical picture, the only therapeutic solution seemed to be the use of an implant supporting a cantilever denture. The unfavourable mechanical component for a 3.3-mm implant pointed to the choice of the Roxolid alloy. The good mechanical properties and the biocompatible surface would allow for extraction and immediate implantation with a screw-retained temporary bridge fulfilling the cosmetic function. The neck diameter of a temporary canine was compatible with the use of an RN neck. The flare of the neck would facilitate a good emergence profile and inter-dental papilla support (Figs. 5, 6).

Clinical procedures

The patient was given local anesthesia using periapical injection and a palatine booster. Teeth 12, 13, 22, 23 were extracted after syndesmotomy then luxation with dental forceps. The alveoli were carefully repaired then two Roxolid 3.3/12 RN implants were positioned at sites 13 and 23. An impression was taken perioperatively, and high healing abutments were screwed on the connectors. One suture was made with polyglactin 5.0 suture to facilitate the stabilization

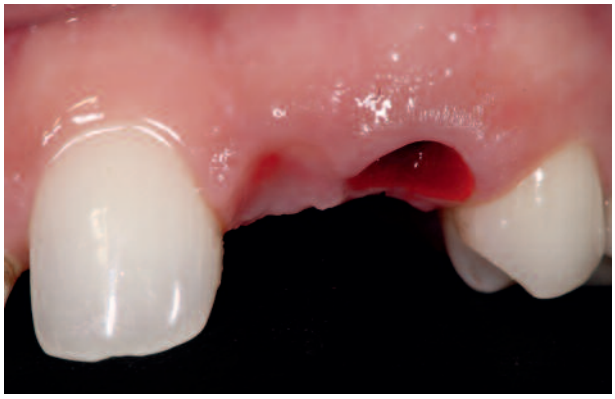

Figure 12

of the blood clot in the alveolus and avoid significant bone resorption. In the denture laboratory, each sector of the rehabilitation underwent the same process. The armature was made from a titanium temporary abutment on which a titanium armature was laser welded. This element facilitates support of the tooth in extension. Two cantilever bridges were made within six hours. The patient was seen again in the practice the afternoon after the procedure. She was given local analgesia by soaking the area with an anesthetic gel. The two bridges were screwed on with a torque of 35 Ncm. Occlusion was carefully checked. Two months of osseointegration were observed before the final denture step. An impression was taken to record the new gingival environment. The color and the surface characterizations were recorded. Two cantilever bridges were made and then screwed on. The temporary bridges supported the papillae during the bone healing phase. Ceramic bridges were fitted to the gingival morphology and preserved the biology and the cosmetics (Figs. 7 – 17).

Conclusion

The remarkable biological affinity and mechanical properties of the Roxolid implant lead us to consider treatment plans differently. The priority is given to the periodontium while managing the inter-implant distances and the peri-implant bone volume as well as possible.

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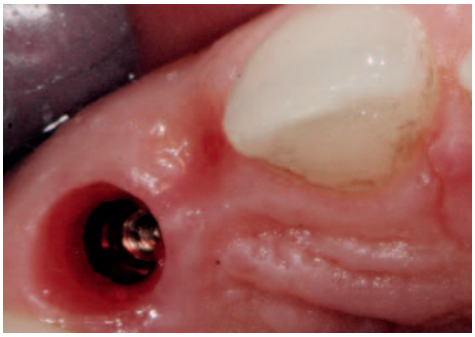

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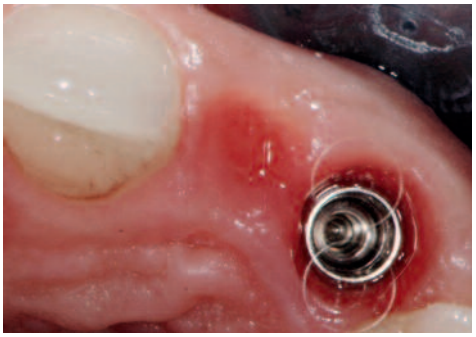

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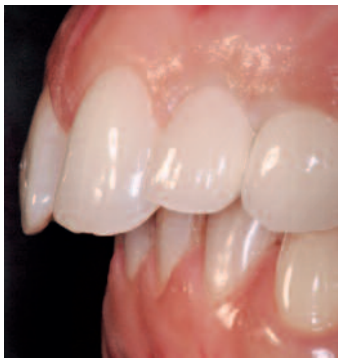

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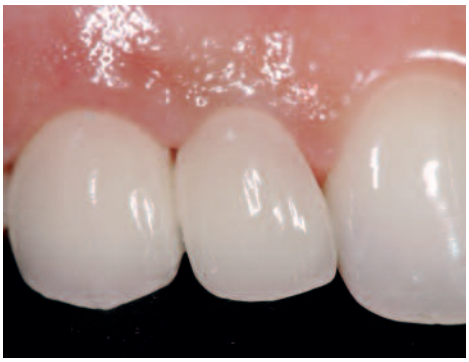

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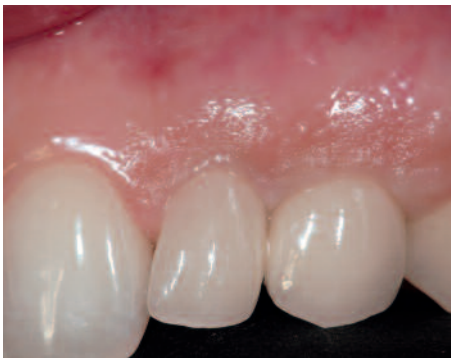

Figure 17

"TiZr has strengthened our confidence in small diameter implants"

An interview with Mathieu Fillion and Dominique Aubazac

What are the benefits of small diameter implants – for patients and in the clinical procedure?

In the future, procedures in implantology will become simpler. Today, many patients decide against implant treatment out of fear of bone augmentation. If the good success rates enable us to insert small diameter implants in poor bone volume, we will increase the number of treatments while at the same time offering the patient a smooth postoperative recovery. Using an implant with a diameter of 3.3mm makes it possible to insert the implant in poor bone volume situations in combination with expansion osteotomy and guided bone regeneration.

What is your opinion with regard to the use of small diameter implants after the introduction of Roxolid®?

Reading the results of the mechanical studies with the new TiZr alloy strengthened our confidence in small diameter implants, and thanks to the arrival of Roxolid® we reintroduced 3.3 mm diameter implants to our treatment plans.

Why did you decide to use SLActive® and Roxolid®? What convinced you to make this choice?

With osseointegration, it is not a clear-cut question of whether the implant is considered osseointegrated or not. Some implants that are considered osseointegrated are, in reality, not, because it is only a small percentage of their surface area that is integrated. This incomplete contact between the bone and the implant can cause subsequent implant failure. During the first minutes following the insertion of the implant, hydrophilia aids the homogeneous stabilization of red thrombus and fibrin thrombus. With optimal cellular bone to implant contact, it is realistic to hope for perfect osseointegration. Up until 2011, we frequently used SLActive® in cases of advanced and complex surgery: immediate load implants, management of poor bone volume, implantation in combination with guided bone regeneration. In view of the excellent clinical results, we decided to enable all our patients and referrers to benefit by using SLActive® and Roxolid®.

In a structure such as ours, in which implantology is our main activity, management of implant failure is extremely costly. What is more, every failure carries the risk of portraying a negative image of implant treatments; all bad experiences are talked about by patients, and complicate the process of acceptance of alternative treatments. Increasing success rates has, therefore, always been our priority. The choice of a high performance surface enables us to follow the developments in implantology, without bringing down our success rate.

What are the benefits of SLActive® for your patients? What are the benefits of Roxolid® for your patients?

The question of the life span of the rehabilitations is a recurring one among patients. Thanks to SLActive®, we have great confidence in our implant treatments, and can give patients good short and long term prognosis. In the case of immediate load implants, we insist on using SLActive®. For implant candidates, Roxolid® is revolutionary, making it possible to increase success rates , and reduce advanced surgery with bone augmentation.

Have you explained the benefits of SLActive®/Roxolid® to your patients? If so, how? If not, why not?

Patients need to be reassured of the clinical track record and reliability of the products, which is why, in initial consultations, we highlight the clinical studies to which we have access.

Have you recommended use of SLA ctive® or Roxolid® to your colleagues? If so, how? If not, why not?

We run an implantology training center. As part of this training, practitioners have the opportunity to insert 6 SLActive® or Roxolid® implants with our support. This gives patients the possibility to benefit from the properties of SLActive®, while the practitioners see the advantages during the treatment process itself.

How do you believe Roxolid® can help to bring dental implantology forward?

The increase in the availability of implantology will be based on reduced postoperative recovery times. Patients whose treatment included bone grafting are generally satisfied with the results, but admit that they would not necessarily repeat the procedure if they had to undergo this stage again. Patients are the best channels of communication between each other, as each successful intervention can represent a further recommendation. The availability of less invasive treatments, i.e. with smaller implants, can help to bring implantology forward and increase the rate of acceptance of treatment plans. We hope that, by using Roxolid® and SLActive®, we will be able to avoid as much as possible the incidence of problems in our patients.

Doctor Aubazac, Doctor Fillion, many thanks for your time.

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