ROXOLID™: The new “DNA” of implant materials—exclusively from Straumann

Straumann has developed a new and stronger metallic material with superior osseointegration properties: Roxolid™, an alloy of titanium and zirconium and the first material to be designed specifically for the needs of dental implantology. Roxolid™, with 50 per cent stronger than pure titanium, the current material of choice for implants, opened the way for its use with titanium (osseointegration) and is recognized for its biological compatibility with the human body and its resistance to corrosion. The discovery that bone integrates with titanium (osseointegration) opened the way for its use in orthopedic surgery and subsequently in implant dentistry, where its physical properties were also important in order to withstand the very strong masticatory forces. As the mechanical properties are limited in the case of small diameter implants (e.g. to replace a lower incisor) the use of alternative materials, such as titanium alloys (e.g. Ti-6Al-4V, Ti64) came into play. However, additional strength came at the expense of osseointegration due to inferior biocompatibility and surface characteristics.

In order to accept no compromise in either strength or osseointegration, Straumann developed the new material Roxolid™. It is composed of the two elements, titanium and zirconium. The combination of these two elements increases the strength of the material. According to published research, titanium and zirconium are the only two metals used in implantology that do not inhibit the growth of osteoblasts, the bone-forming cells that are essential for osseointegration. In addition to this, Roxolid™ can be combined with Straumann’s third generation SLActive®—the gold standard in surface technology—alike of other alloys such as Ti64, which cannot accommodate the sophisticated microstructuring processes required. The unique combination of Roxolid™ and SLActive® enhances safety thanks to the properties of surface and material.

The composition of implant materials plays a key role in dental implantology as it defines the factors leading to implant success. Material has a direct influence on implant strength (mechanical properties) and osseointegration (biocompatibility and surface properties). These properties are fundamental to achieving successful treatment results.

Material strength is defined by the ultimate tensile strength. This value shows the force which can be exerted (on standardised probes) before a material breaks. In order to enhance the strength of titanium it is alloyed with other elements. The combination of titanium and zirconium gives a superior strength to the material, resulting in the ultimate tensile strength of Roxolid™ of 50 per cent, which is higher than that of pure titanium (Fig. 1).

In vitro experiments by Steinemann regarding the reaction of tissue in combination with different elements show the high biocompatibility of Roxolid™ components. In the same publication, Steinemann also states that titanium and zirconium are the only elements which do not inhibit the growth of osteoblasts (based on in vitro testing). In combination with the SLActive® surface, enhanced osseointegration was observed in a preclinical study. The histology from a preclinical study shows the difference between a titanium/SLActive® surface and a Roxolid™/SLActive® surface. Whereas the bone to implant contact is comparable, the newly created volume of bone is significantly higher with the Roxolid™ implant (Figs. 2, 3).

The torque required for removal also gave a higher value for the Roxolid™ material than for titanium. In this preclinical study, Roxolid™ implants with SLActive® surface performed better in 2 out of 3 osseointegration parameters, i.e. removal torque and bone area, whereas the bone to implant contact was similar to that of the titanium implants.

Further preclinical studies are ongoing to investigate the osseointegration behaviour of Roxolid™ with the SLActive® surface. It can be said that the combination of Roxolid™ and SLActive® shows very promising results. It does not compromise either in strength or in osseointegration.

The laboratory tests and preclinical results show the excellent behaviour of Roxolid™. Studies with patients are in order to amass clinical evidence are ongoing.