Straumann® Bone Level Tapered Implant
Scientific Review.

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TAPERED IMPLANTS

Tapered implants are defined as "a specific implant shaft design that incorporates concentric steps that narrow in width towards the apex of the implant."[1] This definition includes all implants where the taper is situated in the cervical, middle, or apical parts, as well as implants that taper continuously from the cervical platform to the apex.[1]
The Straumann® Bone Level Tapered Implant (BLT) was introduced into the market in 2015. Its design properties are based on the principles of the Straumann® Bone Level Implant (BL). In contrast to the Straumann® Bone Level Implant, which has a fully cylindrical body, the body of the Straumann® Bone Level Tapered Implant is tapered at its apical part (Fig 1).

Fig.1: Apically tapered bone level tapered implant.

IMMEDIATE IMPLANT PLACEMENT

The initial quest for tapered implant designs stems from the demand to provide immediate implant placement and temporization.[2] The literature presently offers substantial evidence towards immediate placement and loading in both the partial and fully edentulous mandible and maxilla, proving them to be as predictable as the early and conventional loading.[3] It is evident that immediate placement intends to reduce the number of surgical interventions. Apart from that, the other advantages of this treatment concept are shortening the treatment time and also maintaining the hard and soft tissues at the extraction site.[2] The initial approach of immediate implant placement refers to placing the standard cylindrical implant in combination with the guided bone regeneration (GBR) procedure.[2] The fact that the morphology of the socket post-extraction and the design of the cylindrical implant are not compatible with each other opens up the arena for root form/tapered implants, which are believed to reduce the risk of perforating the labial/buccal plates.[4]
The tapered implant is designed to facilitate immediate placement as it engages the socket bone at the apical and palatal/lingual portions of the alveolar socket walls and provides better adaptation in extraction sockets, even in areas with low bone density.[5] The tapered design presents further benefits by avoiding the adjacent converging roots, buccal bony undercuts, and other vital anatomical structures like the inferior alveolar nerve, mental foramen, nasopalatal foramen, and maxillary sinus.[6]

PRIMARY STABILITY

The long-term survival and success of an implant placed and/or loaded immediately are influenced by various factors[7, 8] but obtaining optimal primary stability remains crucial for immediate implant loading.[9] The stability of an implant is the main prerequisite for bone cell differentiation, and osseointegration and the functional loading of an immobile implant contributes to achieving fast and efficient osseointegration.[9] The other factors include implant design, surface, surgical technique, and bone quality.[9] The relationship between these elements defines the initial stability of the implant. Implant design has been one of the most assessed variables of implant design among engineers and researchers because it can directly influence implant biomechanics in the bone.[6]
The adopted surgical technique also influences primary stability.[9]
For example, the undersized drilling technique can optimize bone density locally and thus improve primary stability.[10] On the other hand, the tapered implant body design allows for under preparing of the implant site, thus increasing the resistance to implant insertion where each following thread of the implant pushes laterally into the bone at a wider diameter than the former thread. The resistance of the bone increases along the implant body as the threads are introduced, and it condenses the softer bone, offering a consistent increase of stability.[7]

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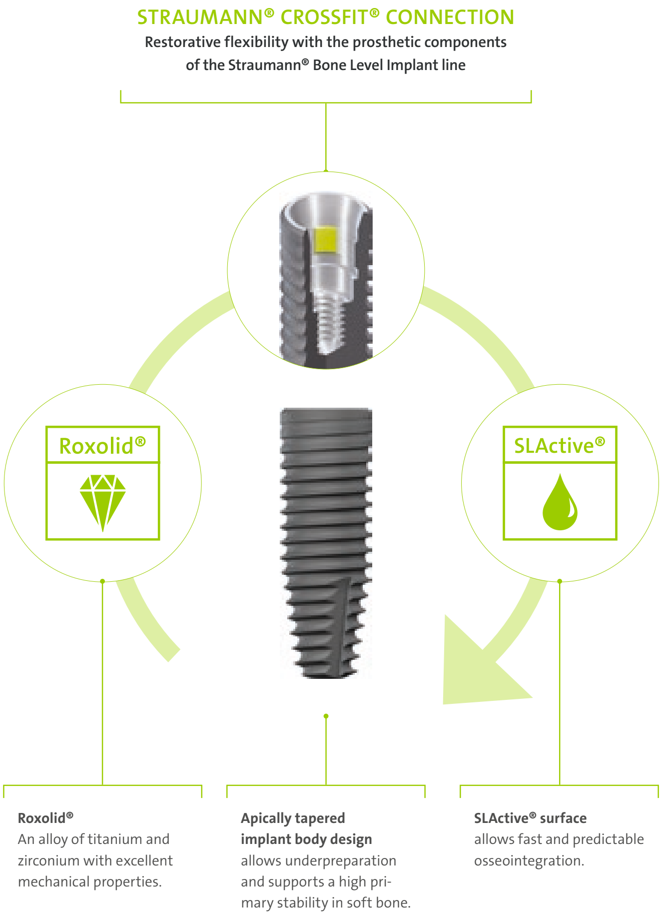
Therefore, tapered implants have been shown to improve primary stability by engaging more of the socket wall than the comparable cylindrical-shaped implant[11] and provide better adaptation in immediate extraction sockets in areas with low bone density.[5, 12]



IMPLANT DESIGN

The longitudinal studies on dental implants show a high survival rate[13, 14] yet the efforts to diminish the treatment time by modifying and adapting the overall design are incessant.

The Straumann BLT® implants have an apically tapered implant body with three cutting notches. This self-tapping effect has reportedly increased primary stability by actively engaging the apical bone, especially in soft bone and fresh extraction sockets.[16, 17]

DID YOU KNOW?

When the implant design was discussed in a study on the future trends in Implant Dentistry (Delphi Study), the consensus was that the shape of the implants should be chosen according to the site of placement. Nevertheless, the survey conducted among the same study participants favored tapered macro designs since they facilitate immediate surgical procedures.[15]

BLT® implants are fabricated in either Roxolid® or pure titanium (grade IV). Roxolid® is a metal alloy composed of 15% zirconium and 85% titanium and has been specifically designed for use in dental implantology. Titanium-zirconium alloys are stronger than pure titanium and have improved biocompatibility.[18, 19]

Along with the implant material, the surfaces like the advanced and proven SLA®[13, 20, 21] and SLActive®[22–24] also play a significant role. SLActive® surfaces have been shown to contribute to initial implant stability by facilitating early wound healing, thus accelerating osseointegration, even in compromised clinical conditions[25–27]. Straumann® SLActive® is a chemically modified, hydrophilic surface that has proven to accelerate osseous healing[24, 28–30] and speed up the process of new bone formation after implant placement, shortening the critical transition phase between primary and secondary stability.

The BLT® is currently available in various diameters depending on the indication. The particularly interesting is the narrow (2.9 mm) diameter BLT® implant. This implant was distinctively designed to restore sites with limited or reduced bone availability. It can enrich the clinician's treatment portfolio and greatly simplify treatment procedures.[30]

EVIDENCE

There is a vast body of evidence that the tapered implant design may facilitate obtaining optimal primary stability[1, 35] even in clinical situations where primary stability is difficult to achieve, including the soft bone or the immediate implant placement.[32] Studies that evaluated the potential differences between tapered and cylindrical implants indicated that tapered implants had similar biological behaviour as well as survival rates during the healing process.[37]

Ever since the launch of BLT® implants, many studies have communicated scientific evidence supporting the use of this implant in specific indications. In a direct side-by-side comparison, BLT® showed comparable clinical outcomes to a parallel-walled bone-level implant.[38]

The histomorphometric analysis also resulted in similar bone-to-implant contact values between the implant types and similarly limited marginal peri-implant bone resorption.[38]

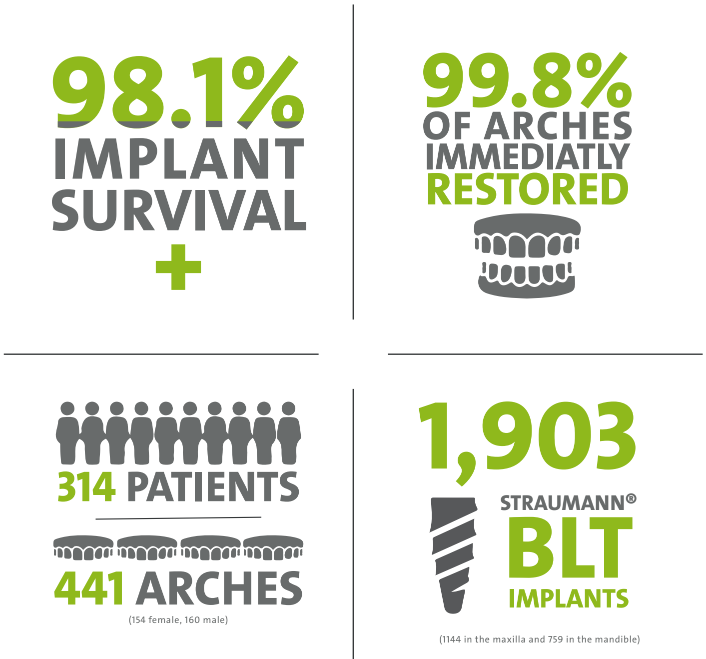
Fig. 2: Histological cross sections, showing well osseointegrated BLT implant.

Primary mechanical stability measured by the maximum insertion torque and resonance frequency analysis is considered to be positively associated with successful secondary stability and implant success.[16] A significantly greater mean maximum insertion torque (59.9 ± 4.94 Ncm) and mean maximum insertion torque/time integral (961.64 ± 54.07 Ncm*s) were documented for BLT® implants compared to other investigated equivalents.[35]
The clinical and radiographic outcomes in partially edentulous patients receiving BLT® implants presented high survival and success rates without mechanical or biological complications after loading. They reported minimal marginal bone loss over 24 months.[32] (Fig 3)(radiograph)

Fig 3: Radiograph showing successful placement of BLT®in a premolar region. (Pic courtesy Dr Pariente)[32]

It was also observed that the use of BLT® implants in immediate placement and restoration of single-tooth spaces ensured the maintenance of the soft tissue contour and esthetics when compared to pretreatment independently from the soft tissue phenotype.[36]
A clinical study of single-tooth replacement in compromised bone using bone level tapered implants with immediate provisionalization in the maxillary aesthetic zone performed well after one year and achieved a good survival rate, and just one implant failed of the thirty that were placed.[41] Finally, a non-interventional, observational study on the BLT® implants demonstrated survival and success rates of 98.2 % and limited bone-level changes over the 1-year follow-up.[42]
Various studies indicated that fully edentulous patients requiring an immediate implant placement and loading could be successfully treated with BLT® implants.[43–45] A non-interventional assessment of the clinical performance of an immediately loaded implant-supported and retained prosthesis wherein 1903 BLT® implants were placed showed a 98.1% survival rate after one year.[43] An observational study with immediate placement and immediate loading to restore full arch in periodontally compromised patients demonstrated a cumulative implant survival rate of 98.94 % and a definitive prosthesis survival rate of 100 % after three years of loading.[41] A retrospective study indicated that this implant design could successfully treat total edentulous patients requiring an immediate implant placement and loading. The improved mechanical properties of these implants might give a more conservative treatment option for the jaws showing a severe horizontal alveolar bone resorption.[40]

These studies confirm that BLT® implants demonstrate high reliability, high implant survival and success rate, and clinician satisfaction in all major clinical situations, including complex SAC cases such as immediate placement and immediate loading.



Eckert, S E. et al.[43]

CONCLUSION

Implant design related to body shape, thread design, surface modification, and surgical protocol used in implant bed preparation directly influence the treatment outcome related to bone preservation.[6] The selection of an implant that will provide adequate stability in the bone of poor quality is imperative. As a growing body of evidence shows, adjusting the implant body shape, particularly by using a tapered implant, has a notable impact on primary stability and, therefore, the overall clinical success. In challenging indications, using an implant system that is clinically proven and supported by scientific evidence minimizes the risk of treatment failure.

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490.674/en/A/00 08/22

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