Flapless MIMI® implantation using the two-piece implant shuttle preventing physiological bone loss

Armin Nedjay discusses Flapless implants

According to valid scientific criteria for a successful implant treatment, bone loss after one-year loading is considered as inevitable. Thus, the implantation is defined as successful when crestal bone loss does not exceed 2mm after one-year loading time and 0.2mm annually thereafter.

With more than 22,000 successful implantations with immediately restored and loaded implant systems, the author describes solutions that have been successful in preventing physiological bone loss. With respect to Tarnow’s findings concerning bone loss, the author has suggested that the periosteum prevents MIMI® procedure with implants that have an integrated Platform-Switching design and that can achieve primary stability has a potential to prevent physiological bone loss. Since bone loss can be evidenced if an implant is uncovered, it is also recommended to avoid implant exposure.

Implant Design & Physiological Bone Loss

Most traditional implant systems have a conventional platform-matched implant-abutment connection. External and internal connections can have an impact on the hard and soft tissue interface. Long-term studies have shown that the peri-implant bone level is established apically from this platform-matched implant-abutment connection (Bullion 1999). If the implant, surrounded by bone, heals with its cap screw in bone until its exposure and if the cap screw is removed by means of osteotomy and replaced with a healing cap, a bone remodeling process starts after exposure. This can lead to a peri-implant bone defect (Fig. 1, implant on the right).

Micro-gap

The micro-gap is located between the implant body and abutment. It has been considered as a disadvantage of two-piece implants. If the micro-gap is too big, there is a high risk of bacterial contamination of the peri-implant micro-gap and implant body. This can lead to bone loss.

X-ray images of some two-piece implant systems (eg ITI), which are connected to the oral cavity, have shown that the biological vertical distance between the micro-gap and the implant-bone contact area is around 2mm, regardless of how deeply the implant is inserted in bone (Herrmann 1997, 2000 and 2001). Tarnow recommends that the minimum distance between two implants should be 5mm to protect bone and inter-implant papilla.

Platform Switching

Implants with a Platform-Switching concept have a proper potential to prevent bone loss. The diameter of the healing abutment is narrower than the diameter of the implant platform/shoulder. In this way, the micro-gap expands horizontally by about 1.4mm, which is similar to the effect in case of a periodontal defect. Tarnow recommends that the minimum distance between two implants should be 5mm to protect bone and inter-implant papilla.

As a rule, an exposure of the Champions (R)Evolution® implant and a reopening/ injury of the sensitive biological width are not necessary. In this way, biological bone loss can be avoided, and the issue according to Tarnow remains to be discussed, also with respect to one-piece implants.

Conclusion

Conventional implantation methods have been increasingly questioned. MIMI® is the abbreviation for the Minimally Invasive Method of Dental Implantation. One-piece implants and also two-piece implant systems will be ideal for MIMI® if they can remain bacteria-resistant even if they are loaded with strong forces.

Implant Tribune

Flapless MIMI® Implementation

Using the two-piece implant shuttle

Customised implant abutment

By Thierry Lachkar

Perio-implantitis

What are the treatment options?

Fig. 1: Implant on the right: Physiologically speaking, bone loss has been considered as inevitable, and some traditional implants are frequently associated with bone loss.

Fig. 2: The epithelial attachment in natural teeth and the one in osseous implants have many features in common, but there are also differences between them. The connective tissue fibers adjacent to the implant are in parallel with the longitudinal axis of the implant, which is different from the biological structures around natural teeth. There are no nerve and vessel structures adjacent to the implant surface; the tissue is similar to scar-like tissue and differs from periodontal tissue, which is connected to the tooth and alveolar bone.

Fig. 3: Soft tissue consists of the sulcus, the gingival epithelium, and the connective tissue attachment. Their vertical height of 5 mm is called the biologic width. A biological cuff-like barrier protects healthy implant surface sites from apical migration of bacteria. Hard and soft tissue, mineralized connective tissue (alveolar bone), soft connective tissue and junctional epithelium serve as a protective barrier. Bacterial migration into the periodontal and periimplant soft tissue in the sulcus area causes an apical migration and destruction of soft and hard tissue, which can lead to an attachment loss. This can lead to bone loss (Fig. 1, implant on the right).
The Shuttle: The two-piece Champions (R)Evolution® implant system consists of an integrated bacteria-proof “Shuttle”/Insert, which remains in the implant for at least eight weeks post surgery until the final prosthetic restoration is fit. During the healing phase in the first weeks, the implant internal thread will not be contaminated with bacteria. During implantation, the Shuttle and micro-close connection protects the internal thread from contamination with bacteria, blood or saliva. With these two-piece implant systems and also one-piece implants, there is very little risk of bone loss. Sufficient primary stability at a torque of at least 35Ncm is a prerequisite for a successful implantation. The implant with the Shuttle can be inserted at a torque of up to 70/80Ncm and achieve sufficient primary stability without deforming or breaking the outer part and inner thread and without loosening the abutment during the prosthodontic phase.

Platform Switching & Optimised Cone Connection: It has been found that crestal bone loss can be prevented with implants with an integrated Platform-Switching design. In addition, internal cone connections should have an angle of 5° to 10°, and the cone should be long enough in order to prevent bacterial migration even if, for example, a 3.5mm-diameter two-piece implant is loaded with a force of 200 N. Since one-piece implant systems have no micro-gap at all, they are bacteria-proof as well. The one-piece implant system is particularly indicated for the rehabilitation of four or more implants/teeth. In order to compensate insertion divergences, Prep-Caps (zircon or titanium) can be cemented. The impression can be cast with super hard plaster (no Laboratory Analogs!) in the dental laboratory. If done correctly, the cement will not be pressed subgingivally so that there is no risk of periimplantitis because of cement remains in these one-piece implant Prep-Caps (“abutments”).

1) The Shuttle: The two-piece Champions (R)Evolution® implant system consists of an integrated bacteria-proof “Shuttle”/Insert, which remains in the implant for at least eight weeks post surgery until the final prosthetic restoration is fit. During the healing phase in the first weeks, the implant internal thread will not be contaminated with bacteria. During implantation, the Shuttle and micro-close connection protects the internal thread from contamination with bacteria, blood or saliva. With these two-piece implant systems and also one-piece implants, there is very little risk of bone loss. Sufficient primary stability at a torque of at least 35Ncm is a prerequisite for a successful implantation. The implant with the Shuttle can be inserted at a torque of up to 70/80Ncm and achieve sufficient primary stability without deforming or breaking the outer part and inner thread and without loosening the abutment during the prosthodontic phase.

2) Platform Switching & Optimised Cone Connection: It has been found that crestal bone loss can be prevented with implants with an integrated Platform-Switching design. In addition, internal cone connections should have an angle of 5° to 10°, and the cone should be long enough in order to prevent bacterial migration even if, for example, a 3.5mm-diameter two-piece implant is loaded with a force of 200 N. In such a case, there is a risk of bacterial penetration into the inner thread and outer part of the implant, which can induce periimplantitis.

3) Due to the flapless MIMI® procedure and the fact that a second or third session is not necessary (implant exposure, subgingival impression), the biological width can be formed and is not disturbed because of a second root surface. For the implant site preparation, the conical triangular drills (not twist drills!) are used, which allow for bone condensation. You prepare the bone cavity depth that corresponds to the endosseous implant length, except if you perform an indirect sinus lift. To ensure perimplant nourishment through the intact periosseum, the 3.0 mm and 3.5 mm-diameter reduced implants are used. The 2.5 mm-diameter implants are only used in individual cases.
intervention (exposure). During surgery, the periosteum, which nourishes peri-implant bone on the long-term, can be preserved. Peri-implant bone nourishment shall be ensured. The minimally invasive implantation method has proven beneficial to the periosteum. In this way, the success rate is comparable to the one obtained in conventionally loaded implants three to six months after implantation. In addition, immediately restored-loaded and delayed loaded implants showed similar bone-implant interface contact rates. In addition, a biologically optimised surface enhances bone cell regeneration.

With these techniques, the risk of physiological bone loss can be reduced or even eliminated. Currently, Tarnows theory about the distance between implants of at least 5mm is controversial. 

**Bibliography**

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‘The peri-implant bone is almost completely nourished by the histological, double-layered bone membrane’

The peri-implant bone is almost completely nourished by the histological, double-layered bone membrane (Stratum osteogeneticum) which is richly supplied with blood vessels and nerve fibres. The inner cambial layer (Stratum osteogeneticum) is rich in cells. It is composed of stem cells (osteoblasts), ensuring bone regeneration. Currently, an intrageneric mucoperiostal flap is not recommended. However, if the gingival thickness is 4 mm or more, crevical incisions (also flapless) can be performed.

The peri-implant, gingival structures and the periosteum, which nourishes bone, remain intact. Physiological bone loss is very unlikely to occur. Current studies and clinical findings over 16 years have shown that the periosteum preserving flapless MIMI® method is very beneficial.

Drilling templates have not always been shown to be particularly accurate in performing MIMI®. On the one hand, the diameter of the Champions® implant is not congruent with the diameter of the conical triangular drills.

On the other hand, studies have compared virtually planned implant positions using current DVT-based navigation-guided templates with achieved implant positions, also involving the use of drills with diameters congruent with the implant diameters.

Apical deviations of 500 μm have been observed. Implants for at least four implants/teeth will be splinted (including fixed, prepared teeth that are positioned mesially from the implants) can be immediately loaded with a final implant-supported restoration within the first 14 days post surgery. Current studies have demonstrated good treatment outcome with regard to stable soft and hard tissue conditions after immediate restoration – also in conjunction with immediate implantation. This success rate is comparable to the one obtained in conventionally loaded implants three to six months after implantation. In addition, immediately restored-loaded and delayed loaded implants showed similar bone-implant interface contact rates. In addition, a biologically optimised surface enhances bone cell regeneration.

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Fig. 19 - 24: When inserting the implants using the flapless and periosteum preserving MIMI® method, we drill the bone cavity transgingivally at a rotation speed ranging from 50 – 250 rpm with the conical triangular drills, depending on the bone density. In most cases, this is done without water cooling. The cylindrical drills are additionally used to prepare the D1 and D2 bone. For preparing the soft D3/D4 bone, it is sufficient to use the conical triangular yellow drill and special bone condensers. After each step, the bone cavity must be checked with the thin BCC (Bone Cavity Check) probe. While avoiding bone overheating, a two-piece Champion (R)Evolution®, which is equipped with an Insert/Shuttle, can be inserted at a torque ranging from 40-60 Ncm without deforming or breaking the inner thread and the thin titanium part (for instance, a 3.5 mm-diameter implant has an approx. 0.4 mm-thick outer part). Sufficient primary stability can be achieved.

Fig. 25 - 29: The bacteria-proof platform-switched Shuttle (see Fig. 11 and “2”), which is set in the implant cone, is restored with a Gingiva-Clix. The Gingiva-Clix is made from white bio-compatible RIN!, and it is available in 6 combinations of heights and dimensions. During the bone remodeling phase within 8 weeks following surgery, the Gingiva-Clix stays on the Shuttle. After 8 weeks, the Gingiva-Clix is removed, and with this particular Clix type, the gingiva is shaped irritation-free. An impression post is transgingivally set in the Shuttle and manually screwed...

Fig. 30 - 34: The Impression Coping is set. After making the impression and the supraconstruction, the Shuttle, which is connected to the implant, is removed with the Shuttle Extractor. The Shuttle is removed for the first time, while the screw remains uncontaminated. After removing the Shuttle, the Abutment (ICA zircon abutment) is screwed seal-tight, preventing bacterial migration. Finally, the crown is cemented and fit.

Fig. 35 - 36: After removing the small implant/Shuttle connecting screw, you can easily remove the Shuttle from the Champion (R)Evolution® with the Shuttle Extractor. This procedure is performed either about 8 weeks after implantation (transition between Primary Osseointegration Stability and Secondary Osseointegration Stability) in many cases or immediately after the insertion of the implants in this case.

Fig. 37: View of the implant in Tooth site 14: when the Shuttle was removed from the implant, the inner thread and the exterior wall of the Champion (R)Evolution® remained intact and was not contaminated with bleeding, saliva and bacteria.

Fig. 38: After removing the Shuttles, the Abutments for Ball-Head are screwed with the Insertion Aid that is also used for one-piece Champion®.

Fig. 39 - 40: The Shuttles are removed from the implants (without local anesthesia because the treatment, including the impression, is performed supragingivally).

Fig. 19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40


Kurtz P: Prospective evaluation of the simultaneous osteointegration stability to secondary osteointegration stability can be assured, we remove the Gingiva-Clix and the small screw from the Insert/Shuttle.


