Pre-implantological bone block osteosynthesis:

# Functional Innovations

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**Enossal implantation has been established as a predictably reliable option for the treatment of edentulous patients. Aimed at approximating complete remission, the implant should meet not only functional requirements, but also aesthetic expectations. The demand that the implant should be perfectly positioned in all three dimensions marks the end of approaches that simply use the available residual bone – and the beginning of prosthetically perfect implant positioning. Perfect implant positioning very often requires bone augmentation, since bone deficits need to be addressed either before or during implant insertion.**

For alveolar crests with advanced atrophy (less than 3 mm in width), simultaneous procedures can be contraindicated because they significantly increase implant failure rates. Here it would be preferable to pursue a two-stage approach where, ideally, an autologous bone graft from an appropriate donor site is transferred to the deficient alveolar crest region before embarking on implant surgery. After a healing period of at least three months, the osseous implant bed will be optimally integrated in three dimensions, ready for perfect implant positioning. In pre-implantological augmentation procedures there is a clear tendency towards intraoral bone grafts harvested from the retromolar region (or possibly from the mental bone or the zygomaticoalveolar crest), but away from extraoral grafts harvested from the iliac crest. The congeneric origin and consequent similar bone structure (due to the neuroectodermal formation of the viscerocranium and the mandible) make intraoral bone grafts the preferred solution, especially with regard to their significantly better absorption properties compared to extraoral iliac crest grafts, where the bone originates from enchondral ossification.

The criteria for successful healing and integration of bone grafts are secure and predictable fixation and tension-free suture closure. But soft-tissue management (incision control, lobe design) deserves at least as much attention as contouring and securing the bone block. Both these factors are interdependent, as excessive stress on the suture leads to dehiscence of the soft parts, eventually resulting in the total or partial loss of the graft. The results of secondary implant insertion in partially integrated grafts tend to be aesthetically less satisfactory. Therefore, solid fixation and secure suturing are an absolutely prerequisite for successful bone grafting. At the same time, the insertion of the graft itself and its connection to the atrophied residual bone should be as easy as possible. The principles of functionally stable osteosynthesis, which also apply to bone grafting, have been known for many years, even since before the introduction of enossal implants. These principles demand secure anchorage within the residual bone, while avoiding excessive compression of the graft at the transplant bed, which would entail the risk of fracture and, consequently, partial absorption or complete loss of the graft.

*Fig. 1 Intraoral appearance indicating severe atrophy.*

*Fig. 2 Intraoperative presentation of the atrophied alveolar crest.*

*Fig. 3 Fixation of the retromolar bone graft.*

*Fig. 4 Presentation prior to suture closure.*

*Fig. 5 Intraoral appearance after two months.*

*Fig. 6 Presentation of the well-healed bone graft after three months.*

*Fig. 7 Secondary implant insertion three months after block augmentation.*

*Fig. 8 Implant reentry three months after insertion and six months after augmentation.*

In most cases, a small countersinking groove is reamed into the bone graft in the region of the sliding hole using a round burr to minimize the stress on the bone block graft at the level of the screw heads. This used to be the only method available to prevent the round screw from exerting excessive pressure during insertion of the graft. Alternative procedures without countersinking groove required the screw head to be left protruding and secured above the graft. For the surgeon, this situation presented the following dilemma: If screw heads were not countersunk, the soft-tissue treatment would be complicated by the protruding screw heads exerting additional pressure on the soft-tissue lobes. Taking neither measure would have resulted in a failed bone graft, because the screw head pressing on the graft would cause stress cracking within the graft, resulting in secondary absorption or failure, while the protruding screw head accompanied by heavier suturing would lead to suture dehiscence and, eventually, complete loss of the graft. The most straightforward way to resolve this was to cut a slight groove in the grafts with a round burr, minimizing the pressure on the graft and improving mucosal adaptation.

With the osteosynthesis screws developed and supplied by Aesculap as part of their Ergoplant bone

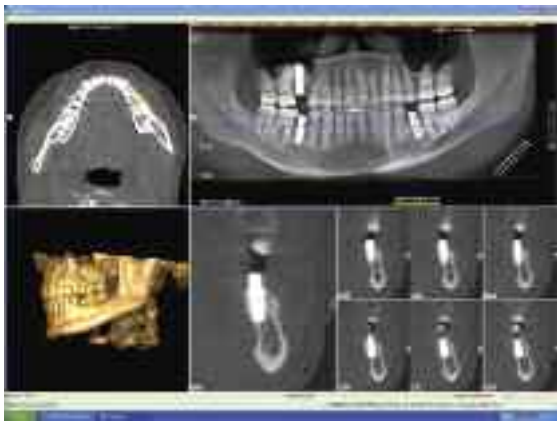

*Fig. 9 iCAT volume tomography of the osseointegrated implant.*

fixation sets, there is now a titanium screw that has a very flat head but will still not shear off thanks to the strong material it is made of. The flat screw head minimizes the pressure on the bone graft without requiring the precaution of countersinking with a round burr. It also greatly simplifies soft-tissue management, as there will be less tension on the sutures caused by increased volume expansion. The microthread of the screw allows quick fixation, with only a few turns, even in very thin residual bone (Figs. 1 to 10).

*Fig. 10 Innovative design of the screw head.*

The innovative head design of the new bone fixation screw together with its new microthread and its very robust titanium alloy facilitate predictable and successful osteosynthesis for securing bone grafts in place. For the implantologist performing augmentations, this means high-quality results through successful and stable osteosynthesis by a simpler and quicker procedure. ■

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