Clinical Performance of a New Biphasic Bone Substitute Material for Sinus Grafting

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Introduction

For about three decades sinus grafting is a proven augmentation procedure in dental implantology utilizing a wide range of grafting materials. Osteoconductive materials with fast resorption kinetics e.g. ß-tricalciumphosphates (ß-TCP) allow for early osseous organisation of the graft, resulting in rapid bone formation. However, various information is given about the resorption stability and volume maintenance of the grafts. Particularly for two-stage approaches, unpredictable volume loss may compromise the following implant placement. Materials with slow resorption kinetics e.g. hydroxyapatite (HA) need more time for complete osseous organisation. Nevertheless, application of HA provides better volume stability of the grafted area.

Results

All implants showed stable hard and soft tissue conditions after a total observation period of up to 18 months. Radiologically, mean loss of vertical graft dimension until implant placement was 0.9 mm for the staged approach. For the non-staged approach, the vertical height loss was 0.4 mm until implant uncovering. The following radiographs revealed no further alterations of the vertical graft dimensions.
Eight trephines of grafted areas could be harvested in the staged group during implant site preparation. Histological analysis revealed complete osseous organisation of the grafts. Porous particles of the bone substitute were embedded in newly formed bone, showing very low superficial resorption of the granules.

Materials and Methods

A new synthetic, nanoporous biphasic bone substitute (maxresorb [MAX], botiss dental GmbH, Berlin) consisting of 60% HA and 40% ß-TCP, was used for sinus grafting in fifteen patients treating 21 sinuses with a total of 50 implants. In 6 out of 21 sinuses, implants were placed after a five to six months healing period as a staged approach. Implant uncovering was performed between three and four months following implant installation. Prosthetic treatment was performed after a soft tissue healing of ten days. After each surgical intervention and at the one-year recall a radiograph was taken. Calibration of the panoramic radiographs was performed by comparison of references or anatomical structures.

Conclusion

Within the limits of the present study it was concluded that the use of MAX for one-stage or two-stage sinus floor elevations shows fast osseous organisation, good volume maintenance and slow resorption. Particularly the good volume maintenance may increase the predictability of two-stage implant treatments in the atrophic posterior maxilla.

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Sinus Floor Elevation and Lateral Augmentation

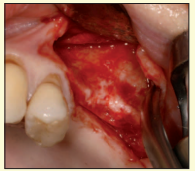
Fig. 1: Sinus wall after mucoperiostal flap reflection

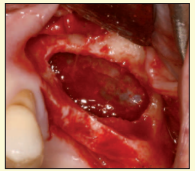
Fig. 2: Situation after elevation of the sinus floor membrane


Fig. 3: Application of rehydrated maxresorb into the sinus


Fig. 4: Additional lateral augmentation for improvement of alveolar width

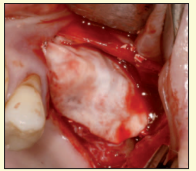
Fig. 5: Covering of the lateral augmentation using a porcine pericardium membrane (Jason®, botiss, Berlin)

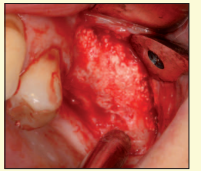
Fig. 6: Clinical situation after 6 months reveals good osseous organization

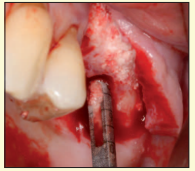
Fig. 7: Trephines were taken after six months in progress of implant drilling

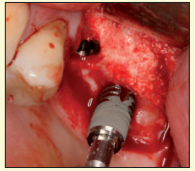
Fig. 8: Implant installation

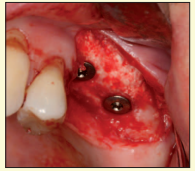
Fig. 9: Final situation

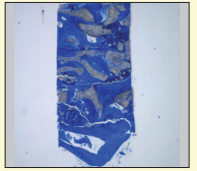
Fig. 10: Histology of anterior trephine shows complete bone regeneration around the granules (40x)

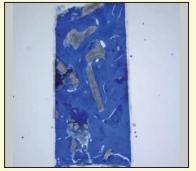
Fig. 11: Histology of posterior trephine reveals mature bone tissue with embedded bone substitute particles (40x)

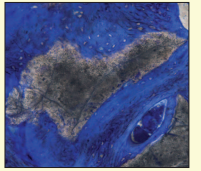
Fig. 12: Granules are well integrated into the newly formed bone showing slow superficial resorption (200x)

Simultaneous Sinus Grafting and Implant Installation

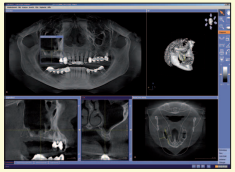
Fig. 13: Preoperative cone beam scan for sinus grafting


Fig. 14: Implant placement and sinus grafting

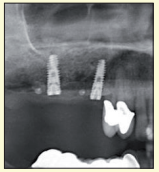
Fig. 15: Postoperative x-ray

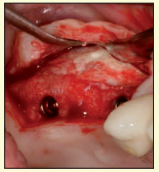
Fig. 16: Osseous organized graft at the lateral sinus wall


Fig. 17: Abutment installation


Fig. 18: Final prosthesis


Fig. 19: Radiological evaluation after 18 months

Two-stage Sinus Grafting I

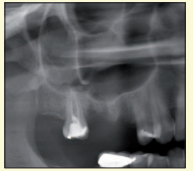
Fig. 20: Radiological situation two months following tooth extraction

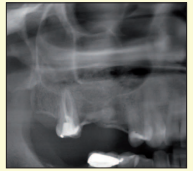
Fig. 21: Postoperative control

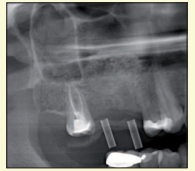
Fig. 22: Minimal height loss of the graft after 6 months healing period

Two-stage Sinus Grafting II


Fig. 23: Cone beam image six months following tooth extraction

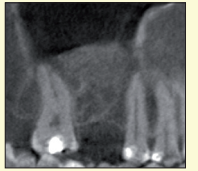
Fig. 24: Radiological situation after sinus floor elevation


Fig. 25: Radiological situation after healing period of 21 weeks and implant placement