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Maxillary sinus floor augmentation using a nano-crystalline hydroxyapatite silica gel

A prospective study—Histological results after 3 months of healing

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Background: The aim of this prospective study was to evaluate tissue composition of augmented maxillary sinus floor 3 months after using of a nano-crystalline hydroxyapatite bone substitute. Histological analysis and bone-to-implant contact (BIC) assessment between the grafting material and inserted miniimplant were achieved.

Methods: Five patients (2 men and 3 women) in need for fixed implant-supported prosthesis in the posterior maxillae were consecutively recruited for the present study. Preoperatively, computerized tomography and digital panoramic examinations were acquired for antral anatomy evaluation. A rectangular or oval-shaped osteotomy was then prepared on the lateral aspect of the alveolar ridge under copious normal saline irrigation. The resulted detached “window” was elevated medially and apically while simultaneously reflecting the sinus membrane. NanoBone[®] mixed with antibiotic solution was placed incrementally at the superior aspect of the sinus and against the medial aspect of the grafted compartment created in the sinus cavity. A mini screw for osteosynthesis of 1.2 mm diameter and 13 mm in length was then positioned to maintain the space opened. After a 3 month healing period, a bioptical core containing the mini-implant was retrieved using a 3 mm trephine bur. In the same surgical step, implants were inserted. After 3 months of submerged healing, implants were restored.

Results: After 3 months of healing, varying amounts of newly formed bone were found through the specimens. From the histomorphometric analysis, NanoBone[®] residuals accounted for 47.35 % ± 5.20 % of the extracted bone volume, marrow spaces presented 19.30 % ± 3.20 % and bone occupied 33.35 % ± 4.1 % (new bone: 22.23 % ± 4.10 %, and native bone: 11.12 % ± 4.20 %). Well-mineralized regenerated bone with lamellar parallel-fibred structure and Haversian systems surrounded the residual NanoBone[®] particles. Mean BIC was 17.75 % ± 2.9 %. No connective tissue was observed at the implant boundary surface.

Conclusion: Within the limits of this clinical prospective study, it can be concluded that nano-crystalline hydroxyapatite bone substitute showed good histological outcomes for augmenting maxillary sinus floor in critical bone volume conditions. Furthermore, the absence of covering membrane and 3-month healing period could clinically demonstrate the potential of this grafting biomaterial. In such a critical condition the use of a rough-surfaced mini-implant showed BIC values supposed to be effective also in case of functional loading.