Microarchitectural study of the augmented bone following sinus elevation with an albumin coated demineralized freeze-dried bone allograft (BoneAlbumin): Preliminary report of a prospective clinical, histological, and micro-computed tomography analysis.

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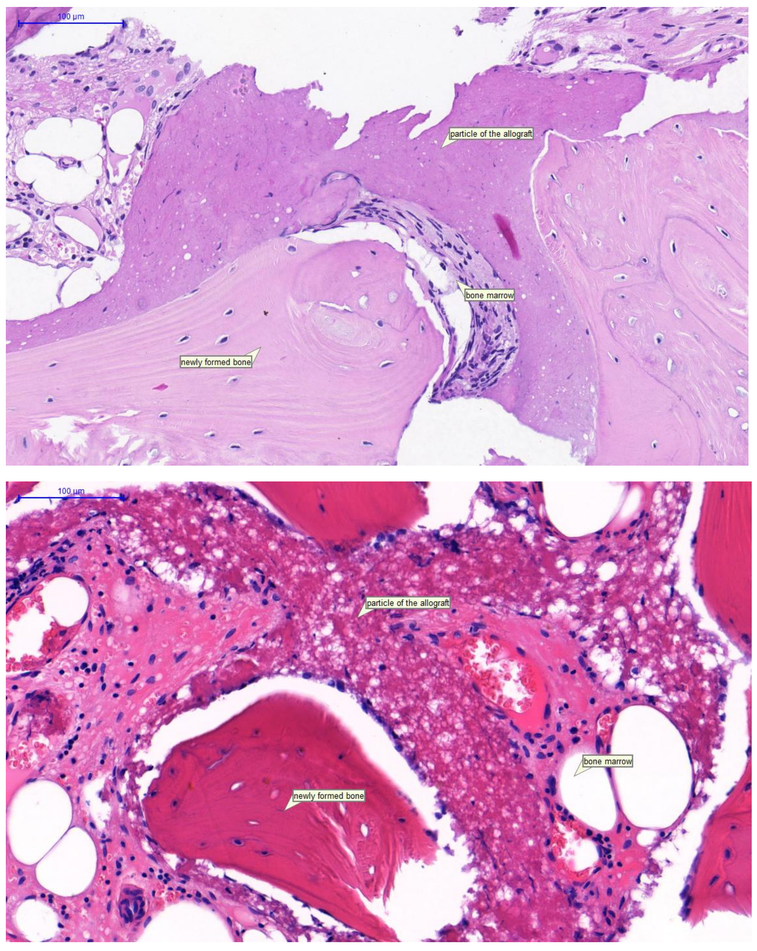
Objectives: Sinus pneumatisation and alveolar atrophy frequently cause insufficient bone volume for implant placement in the edentulous posterior maxilla. Numerous bone substitute materials have been successfully applied for sinus grafting, however, bone remodelling is still an issue. According to preclinical studies albumin induces mesenchymal stem cell growth on the surface of bone allografts and albumin addition to bone allograft (BoneAlbumin) has shown clinical advantages in orthopaedic bone grafting applications. We aimed to evaluate the performance of BoneAlbumin in maxillary sinus augmentation.

Methods: Eleven patients (4 male, 7 female; age: 52,9±9,39 years) were included in the study and 14 sinus augmentations were performed with a lateral window technique. The combination of „BoneAlbumin" („Orthosera", Győr, Hungary) and a porcine collagen membrane („Bio Gide", „Geistlich", Wolhusen, Switzerland) was used in each case. After a 6-month healing period 8 bone core biopsy samples were obtained and implants were placed in the augmented sites. The bone core biopsy samples were examined by histological and micro-CT analysis. Histomorphometric measurements were carried out using a combination of Adobe PhotoShop (Adobe System, Inc., San Jose, CA, USA) and the public domain NIH Image program (US National Institutes of Health' http://rsb.info.nih.gov/nih-image/).

Results: Qualitative histological analysis of the biopsy samples revealed that the particles of the graft material were surrounded by newly formed bone trabeculae and marrow spaces. Figure 1 presents a histological slide from one of the bone core biopsy samples. Figure 2. presents the data otained from the histomorphometric analysis of the biopsy samples. Three dimensional rendered micro-CT images suggest that the BoneAlbumin particles were in direct contact with the newly formed bone trabeculae. Figure 3. presents the micro-CT image of one of the bone core biopsy samples.

Conclusions: Histologic and micromorphometric data of the micro-CT analysis suggests that the BoneAlbumin material successfully integrates into the bone of the posterior maxilla when applied as graft material for sinus elevation. Micro-CT analysis provides invaluable information of the microarchitecture of the augmented bone.

Figure 1.



Histological slides from one of the bone core biopsy samples.

Figure 2.

	M (mean)	SD (standard deviation)
	%	%
Newly formed bone	37,8	7,92
Particles of the bone graft material	6,90	2,24
Bone marrow	55,3	8,83

The data otained from the histomorphometric analysis.

Figure 3.

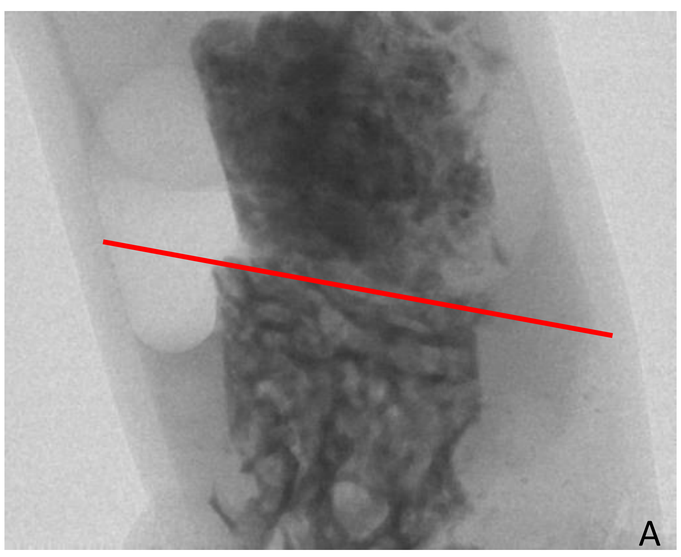


Figure 3/A presents a central, axial section of one of the bone core biopsy samples. The horizontal red line indicates the border of the residual bone and the augmented area of the posterior maxilla. The augmented bone is the more dense structure above the red line. The residual bone can be seen beneath the red line.

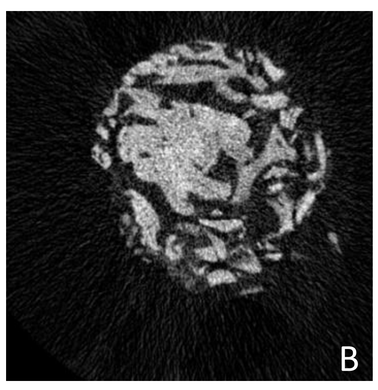


Figure 3/B is a cross section of the bone core biopsy sample at the level of the augmented bone.

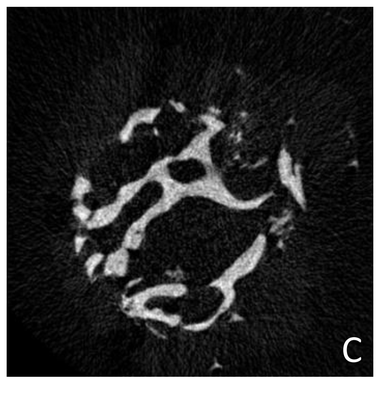


Figure 3/C is a cross section of the bone core biopsy sample at the level of the residual bone.