Histomorphology of bone regeneration after sinus floor elevation with two types of TCP granulate – a case report

Plenk H jr, Lederer J
Zeitschrift für Orale Implantologie 2005: 32-38

Introduction:

In cases where bone is not sufficient in quantity and/or quality for a primarily stable placement of a dental implant, structural and bio-functional pre-conditioning of bone and soft tissue with the help of augmentation material of various kinds is more and more becoming common practice. Since the late sixties, synthetic ceramics based on calcium phosphate compounds have been used for this purpose. Depending on their exact composition, the solubility and degradability in a biologic environment vary which, in turn, leads to different results in regard to bio-compatibility and the extent of bone regeneration.

To make the selection easier for the practicioner, Merten and colleagues have suggested a categorization into "bone replacement materials" and "bone regeneration materials". The osteo-conductive bone replacement materials undergo bony integration. However, due to their low resorption, they remain as a functional foreign body. Bone regeneration materials on the other hand are substituted by bone and achieve "restitutio ad integrum".

Case presentation, material and methods:

During a multi-phase dental restoration in the atrophied maxilla in a 60-year-old patient, a bilateral sinus floor elevation was undertaken prior to implant placement.

In region 24 to 26, the bilateral implantation was performed 4.5 months after augmentation with Cerasorb® [1], a ß-tricalcium phosphate (TCP) granulate. A minimally invasive method was used and endoscopic control conducted. The multi-porous TCP granulate Cerasorb®M was chosen for the augmentation in region 14 to 17 four months prior to implant placement. During preparation of the implant bed, biopsy cylinders from regions 25 and 17 were taken for a histological comparison of bone and tissue reactions.

Two different types of Cerasorb® [1] granules were used in the augmentation:

1) Cerasorb® [1], round microporous granules (500-1000 µm)
2) Cerasorb® M, polygonal granules (1000-2000 µm) interconnecting (open) multiporosity with consisting of micro-, meso- and macropores

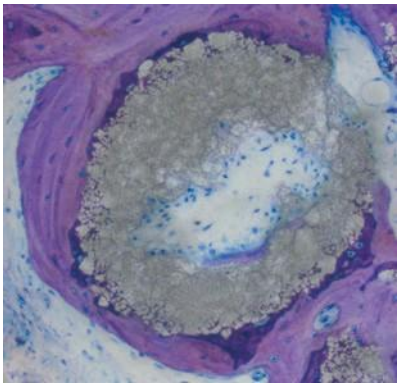

Fig. 1a: central connective tissue penetration and beginning bone formation

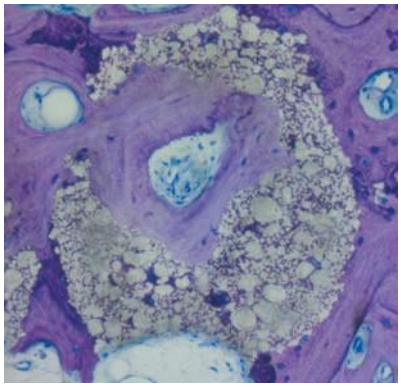

Fig. 1b: central formation of osteons

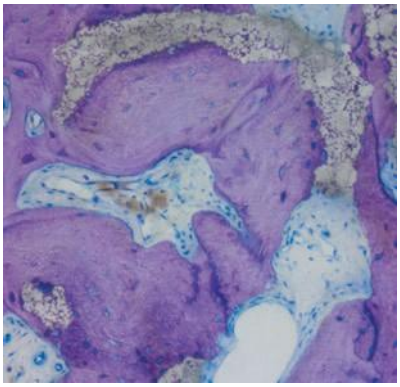

Fig. 1c: remnants of the granule periphery

All three images are taken from the same specimen 4.5 months after augmentation with Cerasorb®. They show the varying stages of granule resorption at the same time. In all cases Cerasorb® is surrounded by lamellar bone tissue (thin section, 150x).

Results and discussion:

In the two median section planes of the sinus floor spongiosa, the bone biopsies from region 25 reveal newly formed bone tissue of varying quantity and density located between the Cerasorb® [1] granules. The roundish, microporous granules show different stages of penetration by vascularized connective tissue and of bony substitution. In contact with newly formed bone, initial as well as advanced states of ceramolysis and bone regeneration were found parallel to each other. A bone-like matrix had grown into the micro pores and between the ceramic particles. Since ramified cells like osteocytes, too, are contained in this matrix, a "ceramo-osseous conglomerate", much like woven bone, is formed first. In advanced stages of bone regeneration, lamellar bone adheres to these woven-bone conglomerates – some-times in the form of osteons with vascular canals.

It is noticeable that often the centers of the granules have disintegrated and are replaced while the periphery of the granules seems to stay intact longer. At 4.5 months after augmentation, the bone tissue formed in between and around the partially dissolved Cerasorb® [1] granules often shows a more mature lamellar structure and functional remodelling due to active bone-building and resorption processes.

In the later restored upper right quadrant, particularly above the alveola of the endangered tooth 17, multiporous Cerasorb® M was inserted by conventional window technique.

In the two median section planes, two thirds of the bone biopsy from region 17 show the alveola partially penetrated by new bone, and only the remaining third shows the augmentation area with Cerasorb®M. The distinctly microporous granules are wholly or partly embedded in vascularized connective tissue which has evenly penetrated all macropores. Newly formed bone trabeculae are visible in and around the granules. In areas with bone contact ceramolysis and penetration of a bone-like matrix take place, and woven bone adheres to the ceramic material. The formation of osteons with vascular canals can be observed in the remnants of former macropores.

Active transformation processes in the newly formed bone tissue and, in some areas, an already completed disintegration of the granule structure indicates successful bone regeneration after a sinus floor augmentation with these two ß-TCP granulates.

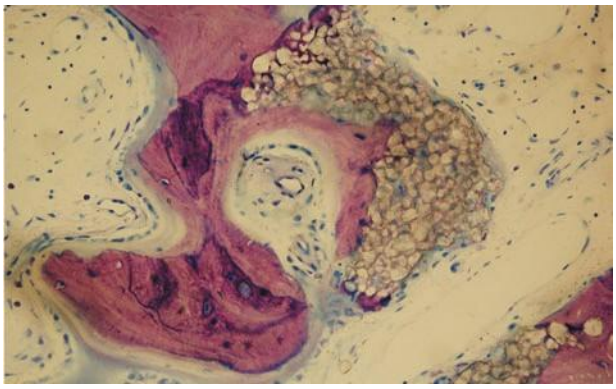

Fig. 2a: Formation of an osteon and active osteoblast bone-building in a former macropore

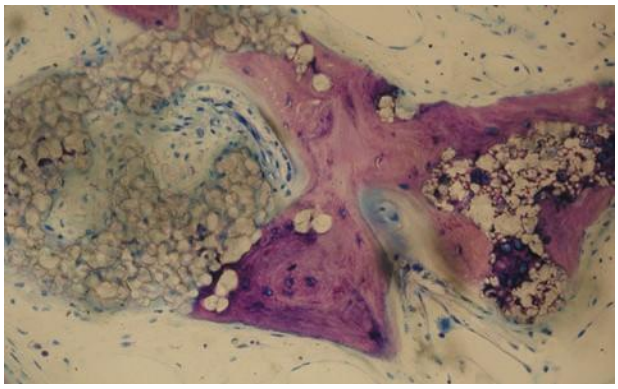

Fig. 2b: Right part of the residual granule in direct contact with bone; formation of a conglomerate of lamellar bone and ceramic material

Biopsy 4 months after sinus lift with Cerasorb M (thin section, 250x, Giemsa surface staining).

[1] Trade name CERASORB® Classic since 2011

Reprinted by permission of the Journal „Zeitschrift für Orale Implantologie"

curasan, Inc. 1009 Slater Road Suite 450 | Durham | North Carolina | 27703
phone 888-237-2767 | fax (919) 941-9775