

# Innovative Bone Substitute for Dental and Maxillo-Facial Applications

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## Introduction

Scaffolds for bone tissue engineering should ensure both volumetric stability and adequate strength. Moreover, their intimate structure should have an interconnected porous network for cell migration and proliferation, while also providing specific signals for bone remodelling and regeneration [1,2].

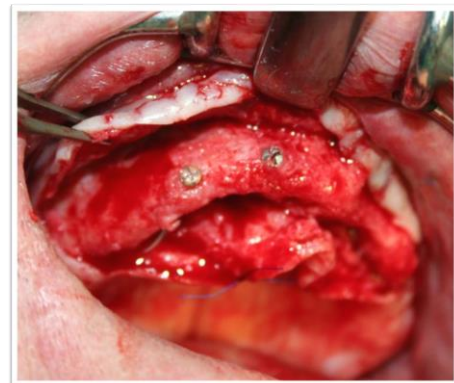
## Results and Discussion

An innovative composite solution, bearing cues from both mineral components and polymeric ones, was here followed to develop a new three-dimensional bone scaffold, SmartBone<sup>®</sup> (SB): a bovine derived mineral matrix is used to provide adequate solid structure and porosity, while resorbable polymers are used to reinforce it. RGD-exposing collagen fragments are finally added to promote cell colonization and proliferation. Previously published results indicate that SB is osteoconductive and osteoinductive, promoting remodelling to mature bone formation in about 8-12 months [3].

High performances of this biomaterial allowed developing custom-made products (a.k.a. SmartBone<sup>®</sup> On Demand<sup>™</sup>, SBoD), solving single specific cases of bone reconstruction: starting from CT scan, personalized grafts can be provided for every kind of defects.



**Figure 1**



**Figure 2**

**Figure 1 and 2:** SBoD implantation at day 0 (fig.1) and at reopening after 8 months (fig.2), perfect integration and no volumetric resorption.

This technology was successfully applied around to 50.000 cases. In previous pictures a custom reconstruction of maxillary bone in a 70-years old male. During surgery, the piece was perfectly located inside the gap and firmly fixed with two osteosynthesis titanium screws. Surgery was fast (<2 hrs) and very precise, allowing to obtain very satisfactory results both in terms of anatomical reconstruction and functionality. The post-operative follow-up recorded no issues of any kind and proceeded optimally.

## Conclusions and/or Outlook

CT scan after 8 months showed impressive osteointegration and massive volume stability (>95%). SBoD custom made bone grafting technique allows complete restoration of wide defects. Histological analysis indicates that SmartBone is osteoconductive, promotes fast bone regeneration, leading to mature bone formation in about 8 months.

## References:

- [1] Kretlow J.D., Mikos A.G. *Tissue Eng* 13(5):927-938, 2007.
- [2] Barrère F. et al. *Int J Nanomed* 1(3) 317-332, 2006.
- [3] D'Alessandro D. et al. *Int J Pharmaceutics*, 523 (2), 534-544, 2017.