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Abstract Form

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Title: Personalized Bone Implant

Objectives: custom-made bone grafting to reconstruct cranio-facial defect due to past osteoma removal

Methods: Grafts for bone reconstruction should ensure both mechanical strength and volumetric stability. Their structure should have adequate interconnected porosity for cell migration and proliferation, while providing specific signals for bone remodeling and regeneration.

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[®] (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 remodeling to mature bone formation in about 8-12 months av.

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

This technology was successfully applied to a custom reconstruction of frontal bone and supraorbital foramen in a 30-years old male: twelve customized grafts were designed in order to fill the complex cavity of the defect, using a puzzle technique with SBoD . During surgery, each piece was perfectly located inside the gap and firmly fixed with small osteosynthesis titanium screws. Surgery was fast (<3 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.

Results: CT scan after 10 months showed impressive osteointegration and massive volume stability (>95%).

Conclusion: SBoD custom made bone grafting technique allows complete restoration of wide defects.

Keywords: *Custom-made implants, bone graft, heterologous bone, SmartBone[®], SmartBone[®] On Demand[™], Cranial surgery,*