

# BioBrief

Major Bone Augmentation



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Dr. Pierre Marin

Regeneration of post-traumatic complex bone defect with a personalized 3D titanium scaffold

# The Situation

A 27-year-old male patient came to our attention. Due to a traffic accident in 2013, 3 fractures have been reported: of the maxillary, of the right orbital floor, and the facial bone (right cheekbone). We noticed the partially edentulous area 14–22 consecutive to the loss of teeth and the extraction

of the fractured ones. Also we observed the inflammatory mucosa due to removable denture with false resin gum. The clinical and radiographic evaluation showed a complex vertical and horizontal bone defect across the entire edentulous area.

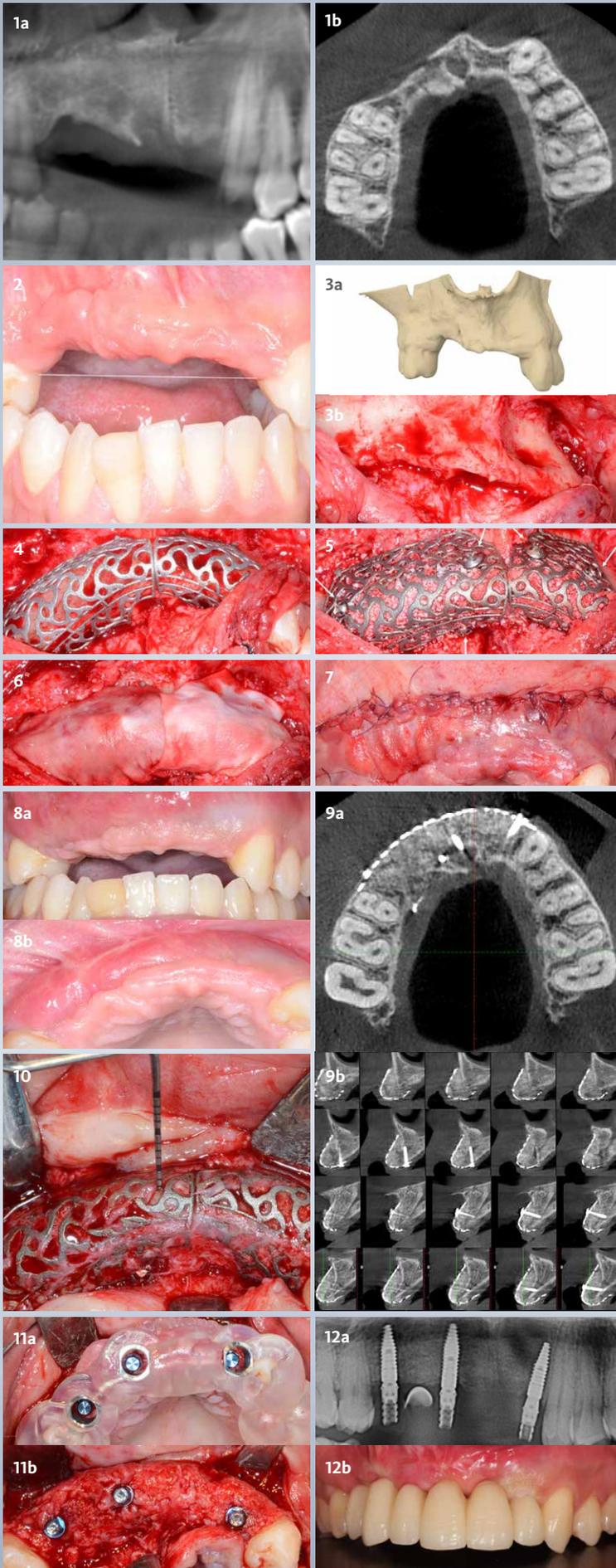
# The Risk Profile

	Low Risk	Medium Risk	High Risk
Patient's health	Intact immune system/ Non-smoker	Light smoker	Impaired immune system/ Heavy smoker
Patient's esthetic requirements	Low	Medium	High
Height of smile line	Low	Medium	High
Gingival biotype	Thick – “low scalloped”	Medium – “medium scalloped”	Thin – “high scalloped”
Shape of dental crowns	Rectangular		Triangular
Infection at implant sight	None	Chronic	Acute
Bone height at adjacent tooth site	≤ 5 mm from contact point	5.5 - 6.5 mm from contact point	≥ 7 mm from contact point
Restorative status of adjacent tooth	Intact		Restored
Width of tooth gap	1 tooth (≥ 7 mm)	1 tooth (≤ 7 mm)	2 teeth or more
Soft-tissue anatomy	Intact		Compromised
Bone anatomy of the alveolar ridge	No defect	Horizontal defect	Vertical defect

“Bone volume is recreated beyond the skeletal envelope. At the time of scaffold removal, there was a soft tissue layer that must be retained and well protected.”



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 Member of the Board of the French Implantology Association  
 Exclusive private practice in Perio-Implantology at ODONTIA Perio-Implantology clinic in Bordeaux (since 1992)



## The Approach

The main goal was to obtain the reconstruction of the bone volume:

- > Horizontally: to restore the vestibular profile and obtain a sufficient peri-implant bone environment (equal to or greater than 2 mm).
- > Vertically: to achieve prosthetic dimensions compatible with the adjacent teeth and therefore to redefine the aesthetics.

An accurate soft tissue handling in terms of tension-free flaps is essential.

## The Outcome

The use of this technique with a personalized 3D scaffold allowed to recreate the bone volume beyond the skeletal envelope. The vestibular alveolar bone wall was restored without over-contouring and the vertical gain permitted the correction of the defect. It was possible to make the three-dimensional positioning of the implants according to the prosthetic project. At the time of scaffold removal, there was a soft tissue layer that must be retained, well protected and should mineralize later.

| 1 Pre-operative X-ray: maxillary anterior partially edentulous space (teeth 14–22) and horizontal+vertical bone defect on the right due to a facial trauma caused by traffic accident. | 2 Pre-operative clinical view of vertical defect. Note presence of post-traumatic reactive thick fibrous tissue. Lower incisor region respectively underwent extrusion, vestibular migration, and distal displacement of teeth 41 + 42. | 3 (a) 3D modeling from DICOM files allows to analyze defect prior to surgery. (b) After palatal flap elevation we can observe the vertical defect combined with the lack of thickness. | 4 Intraoperative fitting of the scaffold. Design respects the anatomical elements (nasal spine, anterior palatal foramen). Vestibular and palatal scaffold sides only connected by small titanium bridges. | 5 Titanium scaffold filled with a 50:50 mixture of autologous bone and bovine bone substitute (Geistlich Bio-Oss®). 1.2mm diameter screws with flat head stabilize the scaffold (white arrows). | 6 The scaffold is covered by a trimmed, but not fixed collagen membrane (Geistlich Bio-Gide®). | 7 Flap is repositioned. At upper vestibular incision, sutures carried out in two deep (5/0 rapid absorption) and superficial (5/0 slower resorption) lanes, completed with transpapillary sutures. | 8 (a) Post-op view at 23 days. Suture removal. Uneventful healing. Keratinized tissue has moved into marginal direction. (b) Post-op view at 65 days. Vestibular arch profile rebuilt. Note slight transparency in region 22. | 9 (a) Tomographic section shows that the scaffold has been perfectly designed to rebuild the maxillary contour. (b) Millimeter sections show the adaptation of the scaffold and the vertical and horizontal bone gain. | 10 Scaffold removal after 6–7 months. Note its integration and presence of a covering soft tissue layer in certain areas. 1.5mm thick immature tissue under scaffold measured with PCPUNC15 periodontal probe. | 11 (a) Guided implant surgery used to avoid any micromovements that would likely traumatize the crestal area which is still weakly mineralized. (b) Ridge covered with a fairly soft tissue that we must preserve. | 12 (a) Panoramic X-ray at 8 months and (b) view after loading of temporary trans-screwed resin bridge. (Dr. J. Leclair, Bordeaux) Patient still undergoing orthodontic treatment.



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## Keys to Success

- Keratinised tissue quality & quantity needed
- Incision choice: more palatal than crestal
- Good ratio autogenous bone/biomaterial: ideally 50:50
- Importance of soft tissue management
- High surgical precision and less invasive technique
- Prosthetically driven implant placement & guided surgery



The regeneration of complex bone defects remains a clinical challenge.

In order to reduce the difficulty of the surgical procedure and to offer our patients a more favorable prognosis, we must use the least invasive techniques possible and adapted medical devices which require less intra-operative manipulation and will consequently decrease operation time and patients' post-operative discomfort.

The Yxoss CBR® personalized 3D scaffold derived from the patient's DICOM files fits precisely and adapts very well to the contours of the defect. It maintains the necessary space for bone regeneration and protects the graft associating autogenous bone and the volume-stabilizing bone substitute Geistlich Bio-Oss®. During the healing phase of the soft tissues the absorbable collagen membrane Geistlich Bio-Gide® serves as a barrier for tissue ingrowth and prevents friction with the titanium scaffold.



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