

# Clinical Sheet

## MAXILLARY SINUS LIFT BY MEANS OF AN EQUINE-DERIVED GRAFT

Histomorphometric evaluation of bone samples after sinus lift surgery.



From the Bioteck Academy Editorial Office

Implant-prosthetic rehabilitation is the treatment of choice for completely or partially edentulous patients. When it involves the upper jaw, it can be a demanding challenge for the oral surgeon, as this area often features low density and poor residual bone volume. These features render the stabilization of the implants difficult and may inhibit osseointegration, therefore increasing the risk of implant failure. In such cases, it is possible to have recourse to the lateral access maxillary sinus lift technique, in order to increase the quantity of available bone tissue.

The technique entails carrying out a lateral access window to the sinus, followed by the detachment of the Schneiderian membrane from the bone floor and its subsequent lifting. Finally, an osteoconductive biomaterial is placed inside the space created between the membrane and the sinus floor. The access window may be covered using a resorbable membrane.

Implant insertion may be carried out in one or two stages: in the latter case, a few months elapse between the sinus lift and the implant placement, to allow an adequate quantity of new bone tissue to form. At the same time as implant insertion it is therefore possible to take biopsy samples to carry out histological and histomorphometric analysis in order to evaluate the performance of the grafted materials.

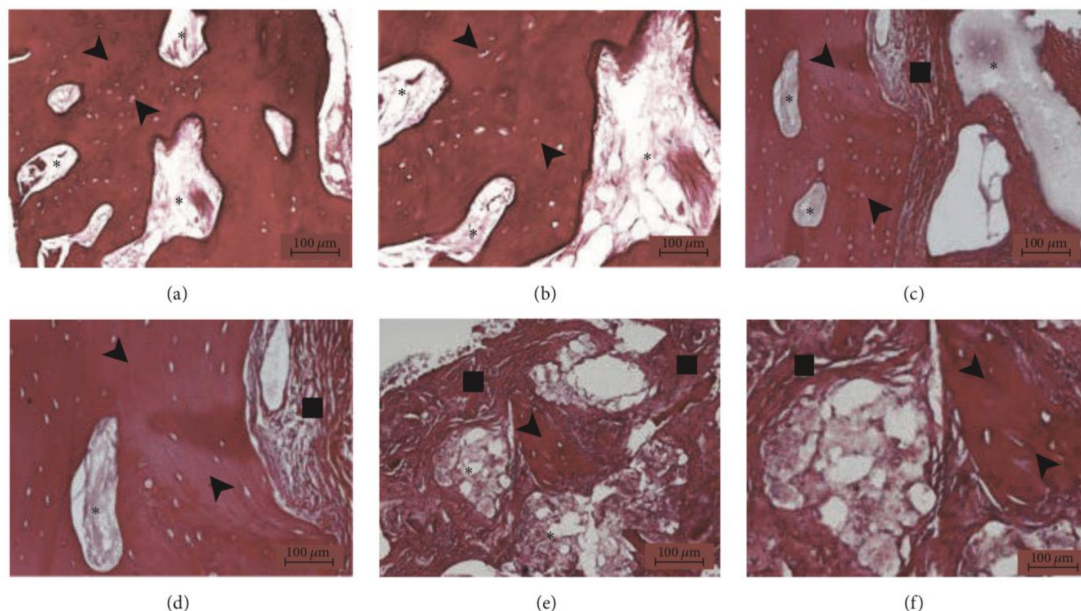
## Materials

The procedures entailed using granular equine bone substitutes (Bio-Gen Mix, Bioteck) and an equine collagen membrane (Biocollagen, Bioteck).

The bone graft is composed of 1:1 cancellous and cortical granules, with a diameter of 0.5 mm - 1 mm. The graft is obtained through the Zymo-Teck enzymatic process, which assures selective elimination of antigens without applying high temperatures or using organic solvents. This process

allows the biomaterial to be recognized in a physiological manner by the cells responsible for bone remodeling, undergoing natural replacement by the patient's own, newly formed bone.

At the end of grafting, the sinus access window was protected using the Biocollagen membrane, a resorbable membrane obtained from equine tendon collagen, whose characteristic ease of handling makes its use very simple, even if not hydrated. It protects for 3-4 weeks.



**Fig. 1** – Histological analysis: staining with hematoxylin and eosin, at 10x (**a, c, e**) and 20x magnification (**b, d, f**). The analysis reveals the prevalence of bone tissue (arrow), the presence of fibrous tissue (square) and the presence of residual biomaterial (asterisk). In panels **a** and **b** one may observe that the grafted material is in direct contact with the bone tissue, which completely surrounds it. In panels **c** and **d** the biomaterial is partially surrounded by newly-formed fibrous tissue. In panels **e** and **f** one may observe that the grafted material is fragmented into small granules surrounded by fibrous tissue combined with bone spicules.

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## Results

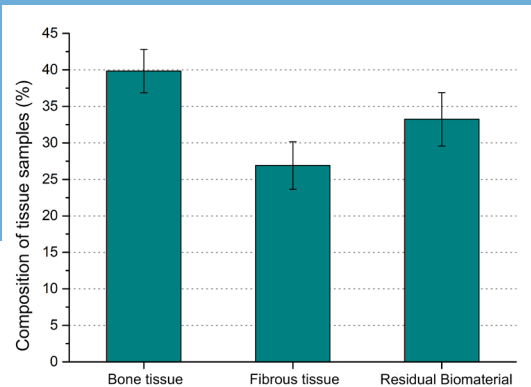
The sheet summarizes the results of a study published in 2017<sup>1</sup>, in which 17 patients with partially or completely edentulous maxilla underwent the placement of a prosthetic implant 6 months after maxillary sinus lift surgery via the lateral route. The patients had residual bone thickness  $\leq 3$  mm.

In the preparation of the implant tunnel, a bone sample was also collected for each patient to be subjected to histological and histomorphometric examination. The bone biopsies, processed by decalcification and embedded in paraffin, were sectioned and stained to undergo histological analysis. The quantity of bone tissue, fibrous tissue and residual biomaterial was then calculated. The ratio of bone volume to total tissue volume (BV/TV) and the ratio of fibrous tissue to total tissue volume (FTV/TV) was also calculated. All patients healed without complications.

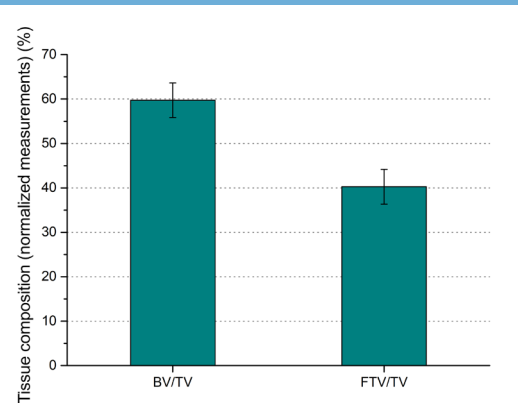
The histological examination revealed the prevalence of newly formed bone tissue, which was in direct contact with the residual biomaterial, thereby confirming its biocompatibility, also demonstrated by the absence of inflammatory reactions.

The histomorphometric analysis showed that the samples consisted of approximately 40% bone tissue, 27% fibrous tissue and 33% residual graft material, whose granules were reduced in size compared to the data provided by the manufacturer, thereby confirming the remodeling activity had taken place. The BV/TV ratio was approx. 60% and the FTV/TV ratio was approx. 40%, indicating a significantly greater area of bone tissue than fibrous.

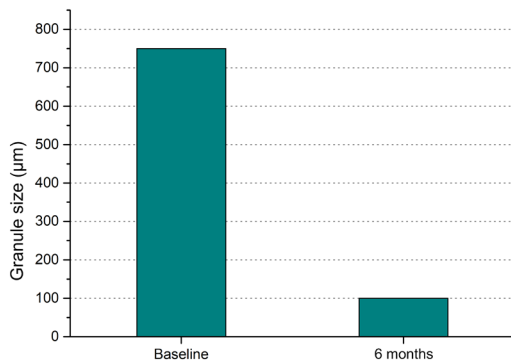
1. Rivara, F., et al. Maxillary sinus floor augmentation using an equine-derived graft material: preliminary results in 17 patients. Biomed Res Int, 2017 Article ID 9164156 (2017).



**Fig. 2** – Histomorphometric analysis: percentage of bone tissue, fibrous tissue and residual biomaterial in bone samples 6 months after sinus lift.



**Fig. 3** – Histomorphometric analysis: ratio of bone volume (BV) to total sample volume (TV) and ratio of fibrous tissue volume (FTV) to total volume (TV).



**Fig. 4** – Size of the grafted granules at baseline and 6 months after the sinus lift procedure.



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