Sinus lift with a synthetic bone substitute

The clinical results are presented by **Dr Fabio Rossi**

Maxillary sinus lift is now a widely accepted technique to enable implant placement in the posterior edentulous segments of the maxilla. The lack of adequate height of the alveolar bone has for a long time limited the insertion of implants in this area.

This lack of bone height results from involutional absorption of the alveolar bone as a result of the absence of the trophic stimulus produced by the teeth and from the concomitant pneumatization of the maxillary sinus. Nevertheless, placement of implants in the atrophic posterior parts of the maxilla in conjunction with a sinus lift procedure is now a predictable and reliable procedure. This surgical technique involves the use of various bone substitutes in conjunction with elevation of the Schneiderian membrane. For many years, the graft material of choice was autologous bone, but in order to avoid the well-known problems associated with this, alternative materials have been developed in recent years.

In the case presented here, we employed histological analysis to assess an innovative material, Straumann BoneCeramic, used as a bone substitute in conjunction with sinus lift. Straumann BoneCeramic is an entirely synthetic bone substitute available in the form of biphasic calcium phosphate granules. It is a mixture consisting of 60% hydroxylapatite (HA) and 40% ß-tricalcium phosphate (ß-TCP).

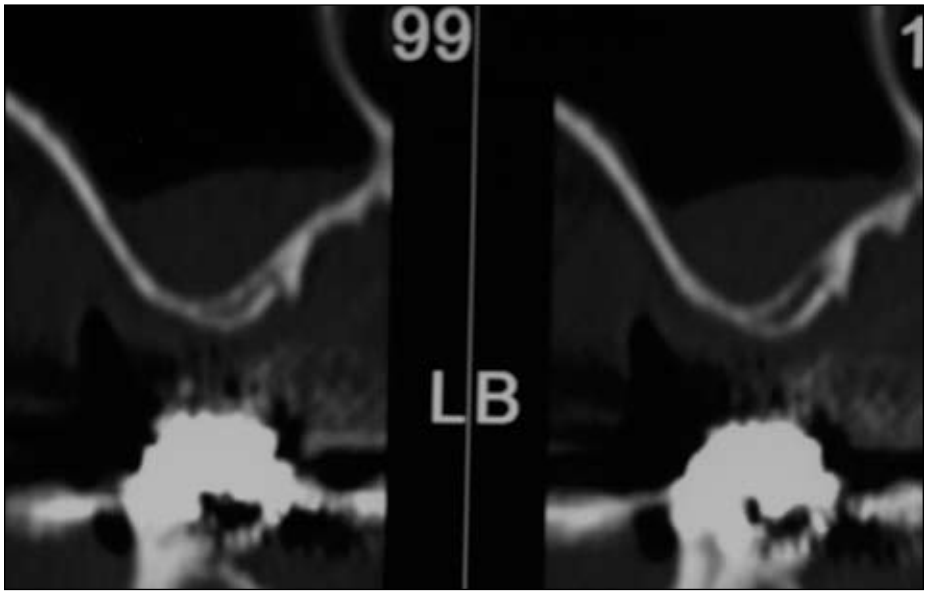


Figure 1

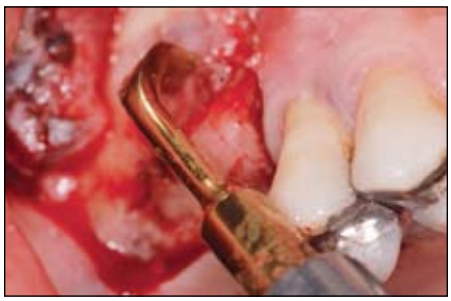


Figure 2

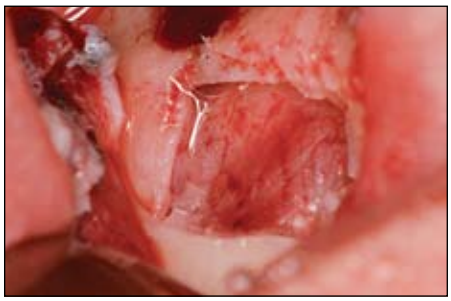


Figure 3

To ensure homogeneous distribution of the two mineral phases, the hydroxylapatite/ß-tricalcium phosphate mixture is synthesized chemically in the initial phase of production. The two components, HA and TCP, are therefore distributed regularly and uniformly in the material. This completely avoids the formation of clusters and promotes homogeneous dissolving and formation of new natural bone. The block from which the granules are obtained has an interconnected porosity of 90%. The diameter of the pores is between 100 and 500 microns. The production process results in a material with physical characteristics that are particularly important for the formation of new bone, namely, crystallinity, porosity and interconnecting pores, providing favourable osteoblast topography.

Initial situation

The patient described here is 49 years old, in good general health and a nonsmoker. In the

Dr Fabio Rossi. E-Mail: farossi@libero.it
• Fellow Researcher at the Faculty of Odontology of Araçatuba (FOA), University of the State of Sao Paulo (UNESP)/Brazil
• Employee of the Department of Maxillo-Facial Surgery and the Oral Unit of the University of Bologna/Italy
• Private practice in Bologna/Italy with specialisation in Oral Surgery and Implantology
• ITI speaker since 2005
• Author and co-author of scientific papers and speaker on implantology
Histological examination:
Dr. Claudia Bertarelli

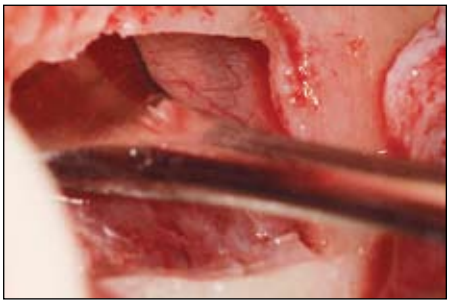


Figure 4

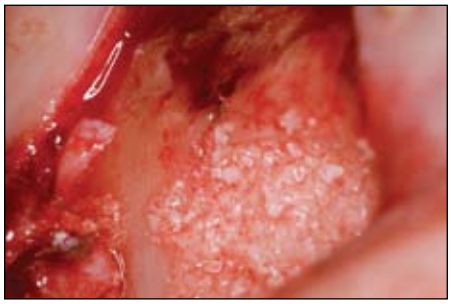


Figure 5

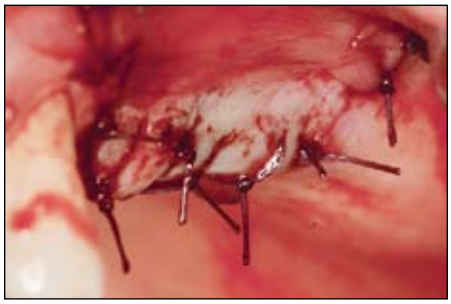
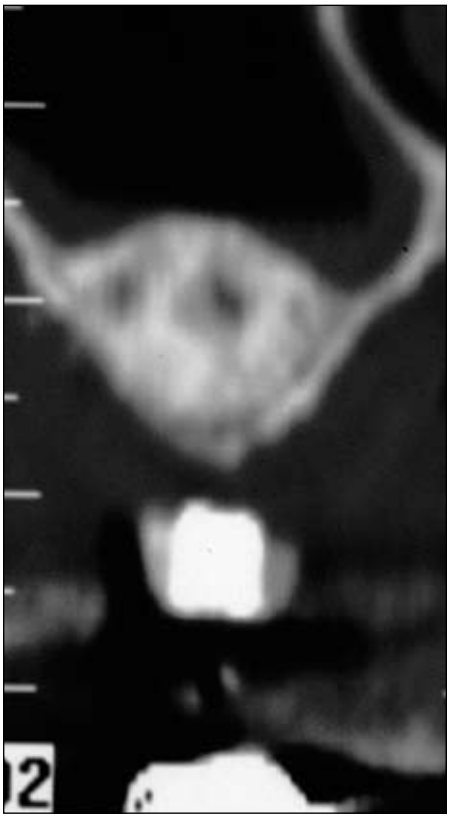


Figure 6



Left: Right. Figure 7

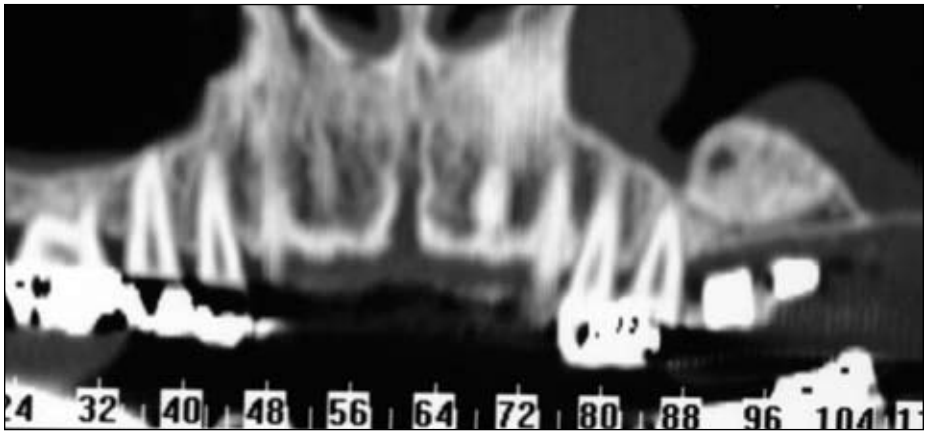


Figure 8

Figure 9

Figure 10

oral cavity he has a distal edentulous saddle in the left maxillary hemiarch. The patient reports having lost teeth 26 and 27 about 20 years ago. The preoperative X-rays and CT with tray show residual bone of 0.5mm in area 26–27 (see figure 1).

Procedure

In view of the patient's request for a fixed restoration in this area, it was decided to carry out a major unilateral sinus lift using Straumann BoneCeramic. Elevation of the maxillary sinus floor was performed using the lateral window technique (see figure 2): an incision was made at the middle of the crest with two extensions (mesial and distal) keeping intacted the papilla. The opening in the bone to access the sinus cavity was made with a piezoelectric device in order to keep the patient's bone fragments in situ. The access window was finished with the OT1piezoelectric (Mectron Italy) insert in order to remove any irregularities (see figure 3). The most delicate step is detachment of the schneiderian membrane, which is achieved with EL1 piezoelectric inserts aided by manual tools (see figure 4).

After detaching the membrane, the Straumann BoneCeramic, previously mixed with the patient's blood and bone (10%, sourcing from the lateral window), is inserted (see figure 5), starting from the inner wall of the palate; subsequently, an absorbable membrane is placed on the access window to the sinus cavity in order to stabilize and protect the previously placed Straumann BoneCeramic. Finally, sutures are placed (see figure 6), maintaining the integrity of the margins.

Following the initial phase of surgery, the patient was prescribed anti-inflammatory and antibiotic treatment together with chlorhexidine gel to be used in the area of the procedure. Six months later, the patient had a follow-up CT (see figures 7 and 8), again with a surgical tray, which showed the presence of an adequate amount of regenerated bone

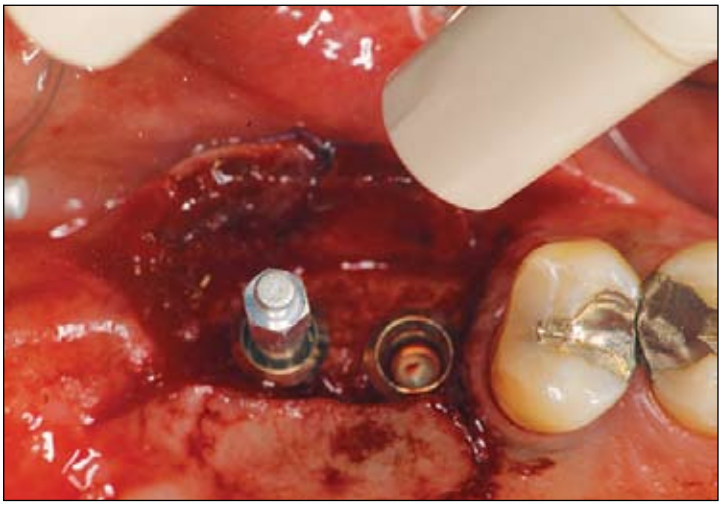


Figure 11

Figure 12

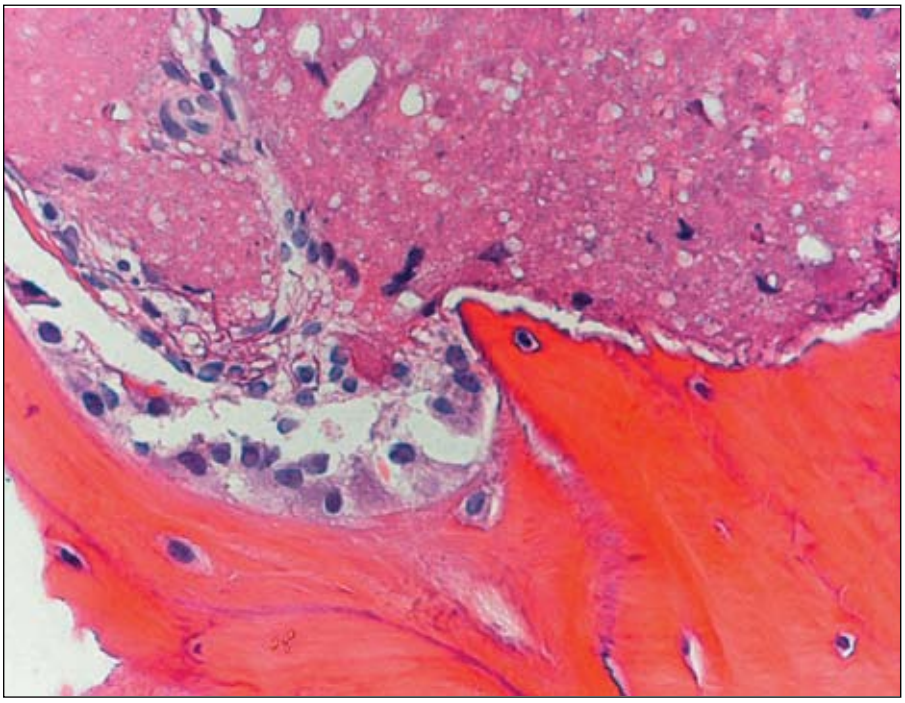


Figure 13

height of 12 mm, which was sufficient to allow placement of two endosseous implants. Two Straumann Standard Plus 4.1 implants SLActive 10mm, were placed in positions 26 and 27. The ISQ was recorded on both implants using Osstell and the values were 70 ISQ and 78 ISQ respectively (see figure 9). At the two insertion sites, a bone core was removed for histological analysis using a specific carrot drill (see figure 10). The wound edges were sutured and the patient was prescribed analgesia for three days.

The sutures were removed after 10 days and tissue healing was satisfactory. Four weeks after placement of the implants, the primary implant stability was measured again with the Osstell; the results were 71 for the 26 element and 80 for the 27. The ISQ was measured again six weeks later and an impression was taken with a screw-fixed device for fabrication of the temporaries, which were then cemented on final Straumann SynOcta abutments (see figure 11). 8 weeks after insertion of the implants, the two final gold and ceramic crowns were cemented (see figure 12).

Histological analysis

See figure 13: Interface between biomaterial and newly formed bone (100 x magnification). Granules of biomaterial in compact form, not yet absorbed, can be distinguished, with cells capable of colonizing the microcavities of the biomaterial. In the lower part, new bone can be seen, which encloses numerous osteocytes clustered in lentiform cavities.

Conclusions

This clinical case yielded satisfactory results. In 8 months, the patient obtained complete restoration of the left posterior hemiarch, starting from an initial situation of seriously compromised hard and soft tissues. The maxillary arch, because of its anatomical closeness to the maxillary sinus and the adaptability of the sinus, is the most predictable are for bone graft procedures using synthetic material.

After 24 months, the patient has no problems; the radiographs show a complete absence of athological peri-implant changes with bone resorption values completely similar to those obtained at the periimplant level of implants placed in non-regenerated edentulous areas. The use of Straumann BoneCeramic in maxillary sinus lift proved to be highly useful; moreover, the method is easily repeatable. In summary, the employment of Straumann BoneCeramic in elevation of the floor of the maxillary sinus has been shown to be very useful; this article confirms the data on the osteoconductive properties of Straumann BoneCeramic, which are useful for developing implant sites in this and other indications such as in post-extraction sockets. I