

Treatment of a Serious Atrophy of the Upper Jaw After a Regenerative Failure with One Phase Titanium Subperiosteal Implant

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Introduction

Subperiosteal implants have been introduced in 1941 by Gustav Dahl and revisited in 1946 by Norman Goldberg and Aaron Gerschkoff and are the customized surgical devices in subperiosteal implantology. Later numerous authors including Linkow LI [1-4], Cranin AN [5-9], Weiss CM [10-11], Bodine RL, Yanase RT [12], Bodine A [12], Chanavaz M., Maurice James Fagan, Robert A. James [13], Martians [14], E. Belotti [15] have contributed to the evolution of the technique with improvements in the design [5,16,17], in the study of the bone-implant interface [11,18], in the microbiological aspects [19], epithelial attack [20-22] and statistical studies [15,23]. The implants have been validated for efficacy, safety and survival by numerous longitudinal, prospective and retrospective studies, long-term follow-up [24-30]. The most relevant retrospective study was provided by Moore and Hansen in an 18-year temporal analysis [31]. The most significant prospective study was performed by Bodine, Yanase, Bodine [32] with a 41-year investigation [23]. Subperiosteal implant, among the techniques available and indicated for the treatment of immediate loading advanced atrophies (Cawood and Howell class VI), is the implant that benefits the longest prospective study. These implants are indicated for the treatment with immediate loading of both total and partial severe and advanced bone atrophies [10] and are alternative or priority to onlay and inlay grafting procedures, to the Lefort 1 osteotomy with interpositional graft, to the intra-extra sinus zygomatic implants (Quad / Hibrid Zygoma).

The technique consolidated over the years requires, after surgical exposure of the surface bone, a direct silicone impression of the maxillary or mandibular bone. Some operators (including myself) took a second impression of the bone surface free of blood traces to ensure the certainty of anatomical details; the impression was cast in plaster and the anatomical replica cast in vitallium. In a second surgical time (generally 3 weeks after the first surgical session) the customized device was applied to the bone. The design phase consisted of drawing the structure by searching for undercuts to ensure the press-fit primary retention. After 40 days from the second intervention, the attack of the deeper layer of the periosteum (sharpey fibers) on the bone directly anchored the

device permanently (secondary stability). Currently the concepts and programming have not changed but the digital evolution [33-36,13] has allowed a qualitative leap for the following reasons: 1) another new therapeutic option in the treatment of severe atrophies; 2) there is no need an impression (which remains the gold standard in precision); 3) allowed a virtual design of the device; 4) extended the possibility of reaching bone surfaces difficult to replicate with the impression (retrotuberal-pterygoid site and hamulus); 5) the operation was reduced to one surgical phase instead of two phases. Contrary to the widespread view of the use of unalloyed and alloyed titanium (which I introduced in Italy about 20 years ago) compared to vitallium it did not improve the integration of the device to the bone and the adverse considerations were declared refutable for those who have experience on field. Titanium alloy in beta phase for greater flexibility is allowed an easier overcoming of bone undercuts compared to vitallium. Titanium compared to the more rigid vitallium has perhaps allowed isoelastic micro deformations and greater conservation of the marginal bone under load.

Case Report

The female patient comes from a regenerative failure (inlay graft and lateral vertical graft) Figure 1.

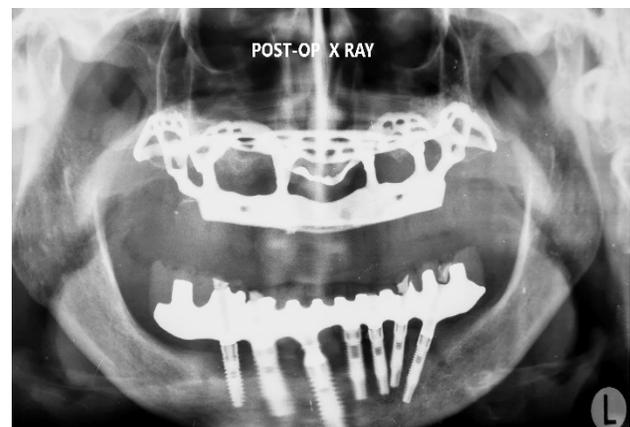


Figure 1: Regenerative failure X-ray.

SUPERSTRUCTURE WITH BOLTS AND FRICTION PINS FINAL AESTHETICS



SUPERSTRUCTURE IN PEK



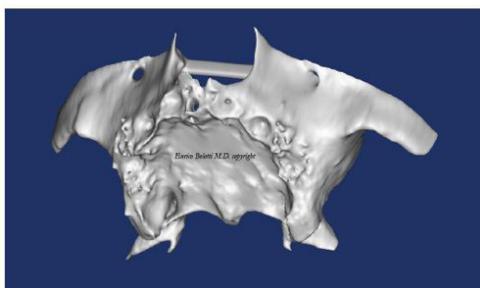
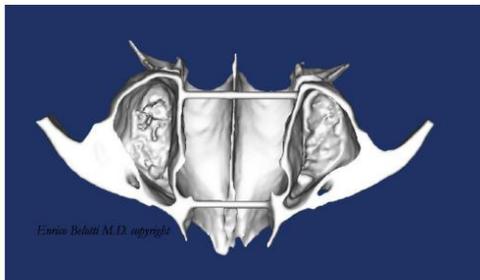
PREOPERATIVE MULTI-LAYER CT: TRACE OF AUTO-XENO GRAFT AND A TRABECULAR BONE PEDUNCLE IN THE SINUS



REMOVABLE PROSTHESIS WITH BOLTS AND FRICTION PINS SUPERSTRUCTURE



3D VIRTUAL RECONSTRUCTION HIGHLIGHTS THE REMAINING PART OF AUTOGRAFT AND THE SOCKETS OF THE FAILED IMPLANTS

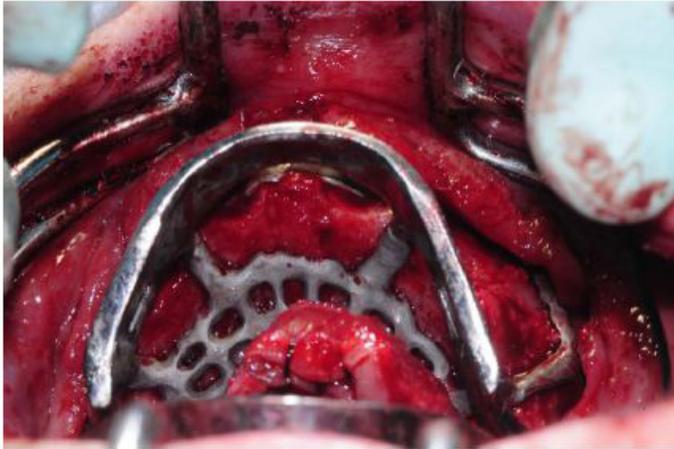


SINGLE-PHASE SURGERY: INSERTION AND SUTURE



THE CUSTOMIZED DEVICE CAST UNDER INERT GAS IN BETA PHASE TITANIUM ALLOY





History:

1) 60-year-old Caucasian female; 2) marked tension and pain to the palpation of the chewing muscles; 3) popping to the left t.m.j. (disc displacement with reduction); 4) smoker; 5) third skeletal class; 6) being treated with antihypertensive drugs (angiotensin II receptor blocker). The patient was subjected to a multilayer c.t. with precise settings. From tomography it is possible to reconstruct the virtual replica of the maxillary bone. From the virtual replica we obtain a stereolithographic model with a resolution of 15 micron. On the anatomical model I drew framework for alloy beta titanium casting. The framework has been sandblasted and passivated. An ambivalent mesostructure was conceived and intended to accommodate both a pek superstructure and superstructure with bolts and friction pins based on the patient's preferences. The pek (polyetherketone) structure has the advantage of being more elastic as opposed to the superstructure with bolts and friction pins. The patient has been subjected to conscious sedation (midazolam) and discharged with fixed temporary in acrylic stiffened by fiberglass and with the following therapy: Betamethasone 2 mg for 5 days; ibuprofene 600 mg bid for 7 days; amoxicillin and clavulanic acid 1 gram bid for 7 days, gastroprotective drug

(lansoprazolo). No complications after surgery. After about 6 months, the work was finalized with a removable prosthesis and a bolt superstructure according to the patient's preference. The restoration of vertical dimension correction and centric occlusion has healing internal derangement and disappearance of the popping and ipsilateral later deviation.

Final Considerations

The interpositional grafts, the inlay and onlay grafts have become the target for vertical and horizontal bone regeneration. The grafting procedure based on osteoconduction and osteoinduction without considering that these biochemical and histological processes can occur partially or not totally may be a wrong choice. The end result is that the patient has undergone major surgery (general anesthesia, not always favorable course, minor interventions of correction and long waiting times for the finalization of the work) without having obtained a favorable outcome. All oral and maxillofacial surgeons with specific interest in severe atrophies should know this technique in order to correct their own failures and as an exit strategy.

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