

## Atrophic sites rehabilitation by use of dental implants and bone regeneration: an analysis of novel tissue engineering clinical approach

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### INTRODUCTION

The introduction of the principles of tissue engineering has certainly changed the clinical approach in the treatment of atrophic implant site. In the study of factors that influence the clinical and biological outcome, a primary role is played by signaling molecules, the scaffold used and the autologous cells, that make up a symbolic triangle of the key elements of tissue engineering. From the results of the pre-clinical studies in the literature [3-4-5-6], it was planned a prospective study on the rehabilitation of the atrophic implant site by tissue engineering technique with TiUnite surface implants. It was therefore tried to assess the regenerative potential in the execution of the guided bone regeneration technique of an allograft soaked with PDGF\_BB growth factor recombined without application of autologous tissue.

### MATERIALS AND METHODS

The study involved the selection of 15 patients without distinction of sex who complied with the following criteria: aged between 30 and 60 years, non-smoking or smoking a maximum of 10 cigarettes a day, absence of major systemic diseases, absence of parafunctions, presence of crestal keratinized gingiva not less than 3mm, depth of the fornix normalized. The research was carried out according to a case series model in increasing operational difficulty

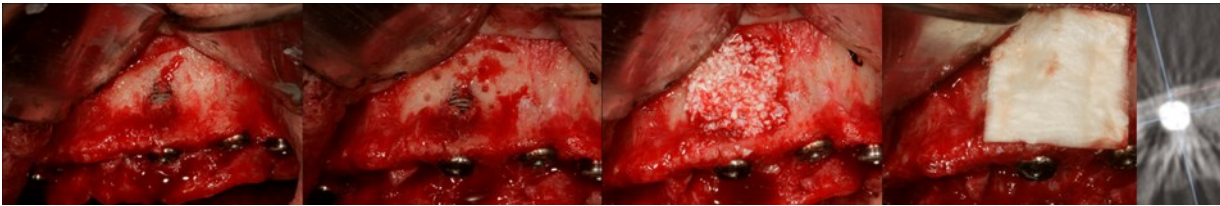
7-8-9 with 5 clinical cases for each level of regenerative potential.

Cases were divided into 3 groups:

- Group 1 -Dehiscences or fenestrations with bone deficits <3mm
- Group 2- Horizontal bone regeneration with bone volume deficit >3mm
- Group 3- Vertical bone regeneration with bone volume deficit >3 mm

It was used a technique of guided bone regeneration with the utilization of an allograft of deproteinized bovine bone (Geistlich Bio-Oss) soaked with rhPDGF-BB growth factor in liquid form. To cover the graft was placed a resorbable collagen membrane. In bone greater defects (group 2-3) was applied titanium mesh (Hess) fixed by trans cortical pins (Terdal) to protect not space making defects.

The 5.0 silk suture was removed two weeks after the first-stage surgery. It was made an antibiotic prophylaxis with Amoxicillin and Clavulanic acid (875mg+125mg) 2g an hour before the operation followed by a therapy of 2g per day for 6 days. The use of 0.2% chlorhexidine was carried out 3 times a day for 1 week before the surgery and until 15 days after.



#### Group I operating sequence

The second surgery step was performed 4 months later. During this phase were carried out tac scans in correspondence of the implant side regenerated belonging to group 1. A biopsy specimen was instead taken with the bone cutter with an internal diameter

of 2mm in cases belonging to the 2-3 group. The cylindrical levy was fixed in 10% formalin and finally longitudinally cut to observe it with a microscope from the portion of the native bone to the most superficial of newly formed bone.



#### Group II operating sequence

In the sites belonging to groups 2 and 3 were placed Nobel Biocare MK III platform RP-surface Ti Unit-ed 11.5mm length implants, with at least one fixture positioned at the site cored. In this phase were rec-

ordered values of insertion torque, of resonance frequency measured with Ostell®10-11 and was assessed by the operator the quality of newly formed bone. It was finally used a 5.0 silk suture removed after 10 days from surgery.



#### Group III operating sequence

The prosthetic timing followed a standard protocol with load delayed to 4 months. The staining of the

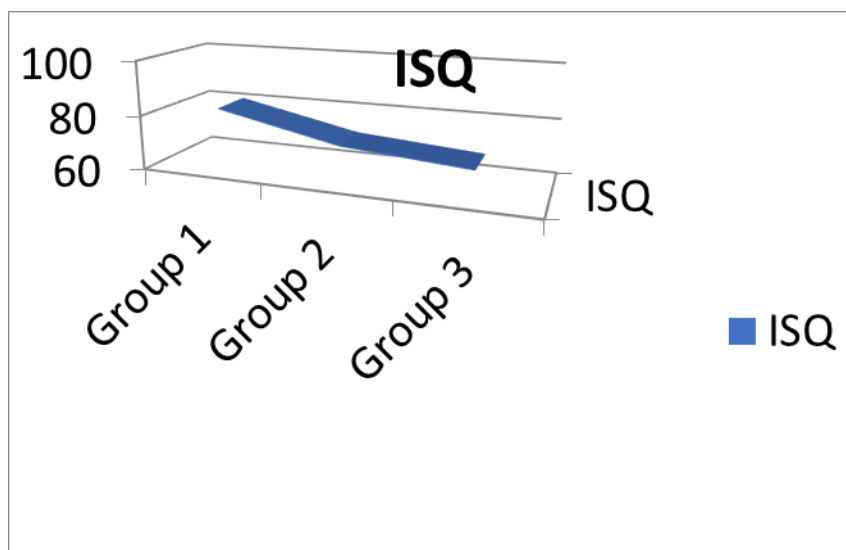
biopsy specimens was done with blue toluidine and hematoxylin eosin.

## RESULTS AND CONCLUSIONS

**Clinical observations:** In Group I cases there was the perfect osseointegration of all implants placed with an average resonance frequency of 81.5 ISQ. The 'X-ray analysis of newly formed bone showed graft integration with the native bone with thinning of the bony cortex. In the cases of groups 2 and 3, the execution of the second stage surgery just 4

months after the first has allowed a more critical analysis of the regenerative potential of the surgical technique. The newly formed bone appeared well vascularized and clearly integrated to native bone. Moreover, in the preparation of the implant site, it was observed in group 3 an increasing value of bone quality in coronal-apical direction. The deviation of the cutter in the buccal-palatal or buccal-

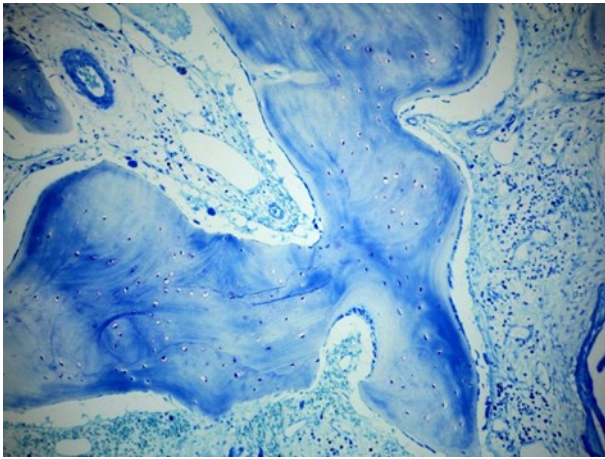
lingual in group 2 showed instead an higher bone density than the regenerated native bone. In both groups, it was evident the presence of particles of Nm in Group 2, and between 30 and 40 Nm in allograft incorporated into the regenerated bone. group 3.



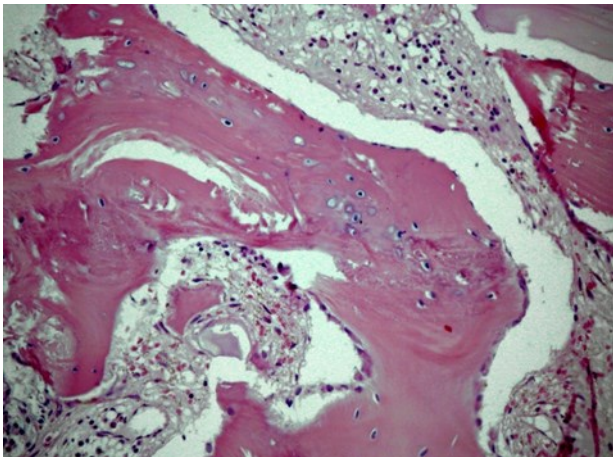
The resonance average frequency detected with ostell® was 72 ISQ in the cases belonging to group 2 and 68.5 ISQ in Group 3.

**Histological Observations:** In both groups (2-3) in the newly formed woven bone. At higher magnification it is possible to observe the presence of particles of allograft during demineralization with numerous resorption lacunae osteocitarie, which indicate the realization of an intense physiological remodeling with alternating demineralization and remineralization. Is finally appreciable an intense osteoblastic activity and an unusually large amount of bone remodeling units (BRU) together with the formation of mature osteons.

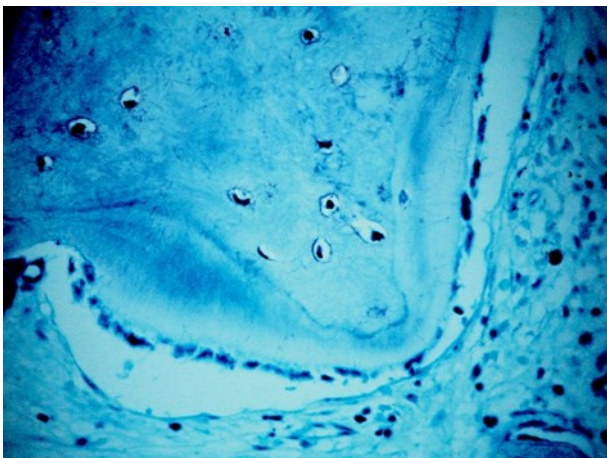
Moving away in the vestibular direction of horizontal regenerations, and coronal in the vertical, we note the presence of healthy connective tissue in remodeling process, in much smaller quantities to



20 x magnification – Toluidine blue



20 x magnification – Hematoxylin eosin



50 x magnification – Toluidine blue

**Conclusions:** Although the study needs more data to be able to assert statistically significant conclusions, the results obtained allow to consider the technique potentially viable both clinically and histologically.

The characteristics of the regenerated bone, although resorbable membranes have been used in conjunction with titanium mesh a little selective, also appears in the most coronal position at a fairly advanced stage of maturation.

This result might be attributed to the angiogenic stimulation performed by the platelet derived growth factor, enabling a speeding up of the regenerative process with an osteogenic induction also by an allograft. From a clinical point of view the confirmation of these results would allow a reduction of the operating timing and a reduction of morbidity borne by the patient.

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