



Biological Bone Drilling in Oral Implantology

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Abstract

Background: The insertion of dental implants involves the drilling process. This drilling process should be as conservative as possible to avoid damage the bone. When this drilling is conservative and no irrigation was used we can obtain bone particles that can be used as a particulate bone graft. The objective of this study is to evaluate the efficiency of a biological low-speed (without irrigation) drilling and to analyze the bone obtained in order to know the viability and vitality of the bone cells contained in this bone.

Findings: In this pilot study were collected samples of biological drilling (low revs without irrigation) and standard drilling protocol in two patients undergoing implant surgery. The samples shall be analyzed by conventional histology and cultivated in order to observe cell growth. The samples of bone obtained by biological drilling shows living cells in the conventional optical microscopy and cell growth when it is cultivated. The bone obtained with drilling at high revolutions shows no living cells and when to be cultivated not obtained cell growth. Moreover, the preservation of bone particles of biological drilling was more effective to support the cell survival more than physiological saline.

Conclusions: The biological drilling at low revs gives us the possibility of collect bone grafts in a simple manner. This collection of bone allows us the treatment of areas in the same surgical phase that would require bone grafts. Bone Presevation in Endoret (PRGF) is more effective than physiological saline in supporting cell survival.

Introduction

The objective of the drilling for the insertion of a dental implant is the realization of a neo-alveolus that is adapted to the morphology of the implant that will be placed through the use of burs to withdraw the bone of the implant site. The standard technique to prepare the future site of the implant consists in a high speed drilling with irrigation. This technique produces bone damage in some cases in which the irrigation not able to get to the final part of a neo-alveolus [1-3]. Moreover, this technique does not allow us to collect the bone with his biological properties because the irrigation washes the bone and the proteins inside in. When using a low revs drilling protocol without irrigation, method called as "biological drilling" [4-6], the bone removed in the drilling process is retained in the bur and can be collected easily. Once collected the bone can be maintained in plasma rich in growth factors (PRGF®-Endoret) to maintain the correct viability of the bone and facilitate better management of the graft [7,8]. The objective of this pilot study is to evaluate the efficiency of a biological low-speed drilling and to analyze the bone obtained in order to know the viability and vitality of the bone cells contained in this bone comparing with bone obtained with high speed drilling protocol (conventional protocol). To this, we collected samples of biological drilling (low revs without irrigation) and standard drilling protocol in two patients undergoing implant surgery. Once the samples were recollected the bone of biological drilling remained embedded in PRGF-Endoret fraction 2 (not activated) until the time of his analysis. Plasma rich in growth factor was prepared using PRGF-Endoret Kit (BTI, Vitoria, Spain). Briefly, citrated venous blood was centrifuged at 480 g for 8 min to separate blood components. Then, plasma column was fractioned into fraction 2 (F2) defined as the 2 ml of plasma above the buffy coat and fraction 1 (F1) defined as the plasma column above the F2. The bone collected from the high speed drilling (filter) was preserved in saline solution (0.9%).

Findings

Once collected, the cells were embedded in phosphate-buffered saline PBS with antibiotics and antimycotics. Tissue was explanted in Osteoblast Medium with antibiotics, 15% fetal bovine serum (FBS, Biochrom AG, Leonorenstr, Berlin, Germany) and osteoblast growth supplements (Sciencell Research Laboratories, Carlsbad, California, USA). Alveolar bone cultures were incubated at 37°C

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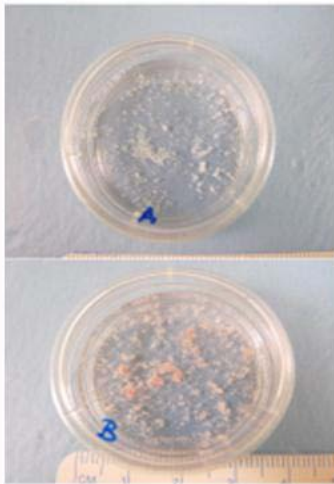


Figure 1: Bone particles harvested during high-speed bone drilling with irrigation (A) and low-speed bone drilling without irrigation (B). Note the higher particles diameter in B.

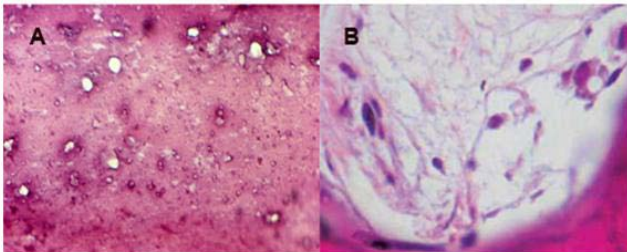


Figure 2: A) Histological images of bone particle after high-speed bone drilling with irrigation (bone with empty lacunae). B) Histological images of bone particle after low-speed bone drilling without irrigation (bone with living cells).

in a humidified 5% CO₂ atmosphere and medium was changed twice a week (Figure 1). When we look at the samples with conventional optical microscopy, we observe one essential difference. The bone of the filter, it is an acellular bone in which there are not living cells in the bone spaces where they should be placed (empty cells) (Figure 2a), while in the bone obtained by biological drilling we observe living cells intact in their bone structure. The bone of the biological drilling with optical microscopy shows alive cells, maintained bone architecture and the size of the bone particle significantly higher (Figure 2b). Due to the absence of cells, in the bone obtained by drilling at high speed, it was not possible to cultivate and expand osteoblasts. In the bone obtained through biological drilling was cultivated by the technique of explants. To this the bone are distributed in fragments on the surface of cultivation. Once distributed is added ObM with antibiotics and antifungal medications (300 µl) and maintenance in incubator white room. The follow-up was realized 3 days a week and annotation file the day in which appear the cells in culture. The migration and proliferation of osteoblasts was positive in all the samples cultured obtained by biological drilling (Figure 3). Figure 4 shows the effectiveness of Endoret (PRGF) to preserve the bone particles as evidence by significantly higher cell survival in comparison to physiological saline.

Conclusion

The biological drilling at low revs gives us the possibility of collect bone grafts in a simple manner. This collection of bone allows us the

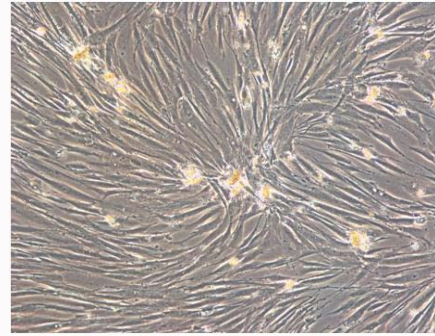


Figure 3: Images obtained with an inverted optical microscope x20 of primary cultures of osteoblasts derived from low-speed bone drilling without irrigation.

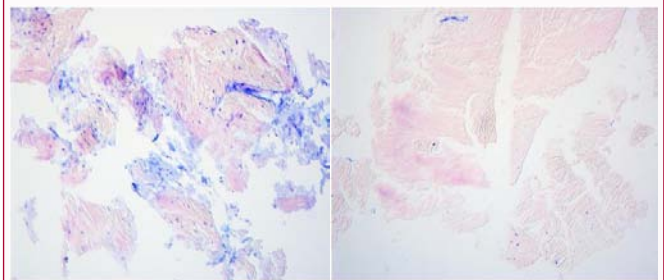


Figure 4: In low-speed bone drilling without irrigation, bone preservation in Endoret (PRGF) increased the survival of osteocytes and other cells (A). Bone preservation in physiological saline did not increase the cell survival.

treatment of areas in the same surgical phase that would require bone grafts.

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