Ultra-slow drilling to obtain autologous bone graft in
implantological rehabilitation. A forgotten technique with
great advantages

Gustavo Bustamante1,2, Francisco Vives3, Claudia Angulo4, Enmanuel Parra4*.

ABSTRACT

Osseointegrated implants are currently the prosthetic treatment by predilection in the oral cavity when dental organs have been lost1,2 and new protocols and technology have been generated for its improvement, raising the success rate and reducing failures, having the osseointegration phenomenon as a focal point2,3.

Bone deficiencies interfere with the placement of these prosthetic attachments; to solve this lack of bone tissue in alveolar ridges, autologous, homologous or heterologous bone grafting techniques are proposed which can be performed in the same surgical act of implant placement or as a previous step to obtain the necessary dimensions. Obtaining autologous bone in oral surgery can be performed in different anatomical areas, such as the mandibular ramus and symphysis, but it has the disadvantage of the donor site morbidity associated with the collection site2,3.

Due to this, techniques are proposed in order to eliminate the need for an intervention in another anatomical region other than that of the implant receptor bed, such as ultra-low speed drilling; in which, at low revolutions without irrigation, it is possible to collect autologous bone at the time of preparing the surgical site before placing the dental implant, which provides the best properties for bone regeneration without the need for another wound or more morbidity for the patient. We describe our ultra-low speed drilling protocol step by step, obtaining autologous bone from the same surgical site to rehabilitate small bone defects around the implant reducing comorbidities and surgical times.

INTRODUCTION

Osseointegrated implants are currently the prosthetic treatment by predilection in the oral cavity when dental organs have been lost4; and new protocols and technology have been generated for its improvement, raising the success rate and reducing failures, having the osseointegration phenomenon as a focal point5.

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Due to this, techniques are proposed in order to eliminate the need for an intervention in another anatomical region other than that of the implant receptor bed, such as ultra-low speed drilling; in which, at low revolutions without irrigation, it is possible to collect autologous bone at the time of preparing the surgical site before placing the dental implant, which provides the best properties for bone regeneration without the need for another wound or more morbidity for the patient4,5.

This technique described in 1985 has abundant benefits and advantages6, but currently, due to its disuse, few investigations analyze ultra-low speed drilling to obtain the bone graft in the same recipient bed of the implant. Even less reported are the protocols used to satisfactorily achieve a drilling technique that allows an adequate amount of bone to be collected and which reflect the long-term results in terms of bone gain. In the present investigation, we describe our ultra-low speed drilling protocol step by step, obtaining autologous bone from the same surgical site to rehabilitate small bone defects around the implant reducing comorbidities and surgical times. The autogenous bone collected by this procedure may be easier to manipulate than bone collected by other means and can improve the osseointegration and bone formation process around the implant.

CASE REPORT

A 46-year-old female patient with no relevant medical history, total maxillary-mandibular edentulism and with a type IV alveolar ridge according to the Cawood and Howell6 classification was included in the study (Fig. 1). The imaging study revealed a mandibular alveolar rim greater than 10mm for the placement of dental implants (Fig. 2) and virtual planning was performed with Planmeca Romexis Viewer software7 (4.6.2 version) for the placement of two 3.75x10mm dental implants (Smart IQ® implants) respecting adjacent anatomical structures.

Figure 1. Alveolar maxilla-mandibular ridges edentulous.

Figure 2. Initial panoramic X-ray.

Surgical procedure:

Under local anesthesia with 2% lidocaine with epinephrine 1: 100,000 (New Stetic®), a circumvestibular incision was made with a #15 scalpel blade in the anteroinferior region and a full-thickness mucoperiosteal flap was elevated. Drilling was carried out with conventional drills from the Standard Surgical IQ Kid®, programming the surgical motor (W&H® model SI-1023 with angled part 20:1 model WS-75 L of the same brand) at 1,000rpm with a torque of 40N/cm for the initial drill by drilling the cortical plate with external irrigation with 0.9% saline solution (a type I bone according to Lekholm and Zarb8 was evidenced). Then, the surgical motor was programmed at 150rpm with a torque of 80N/cm, without irrigation, using the sequence of conventional drilling (initial drill, 2.0mm, 2.3mm, 2.7mm, and 3.2mm); obtaining autologous bone particles along each drill (a total of 0.5cc of bone was collected) (Fig. 3). Two dental implants measuring 3.75x10mm (Smart IQ® implants) were placed in the prepared beds (Fig. 4). The bone obtained...
from the aforementioned motor drills was grafted onto the dental implants (Fig. 5), hemostasis control and primary closure with 5-0 nylon suture were performed. The procedure was completed without complications, postoperative care and oral home medication were indicated.

In the post-surgical control at 7 days, the patient was in good general conditions, asymptomatic, with no evident swelling. Intraorally, tissues were in healthy healing process, without neuro-sensory involvement of both mental nerves. A control panoramic x-ray control was requested, showing correct positioning of the dental implants.

**DISCUSSION**

In 1985 Thomas Driskell devised an implant system called Stryker® that recommends a speed of 1,000rpm with the initial drill, and the remainder of the drilling sequence at low revolutions (50rpm), all with irrigation. Drilling at low revolutions (50rpm-100rpm), allows better control of the direction and depth of the drilling, does not increase the temperature of the surrounding tissue from overheating(7,8). However, irrigating with saline solution could drag and dissolve low molecular weight proteins such as morphogenetic proteins, bone proteins, osteoinductor proteins, growth factors and other soluble substances whose function is to transmit activation messages to local cells so that they can react to stimuli such as those related to drilling(9). It would then be wise to opt for bone drilling techniques that avoid irritation during the procedure stripping the tissue of the natural resources it uses to heal itself. In our case, the use of the surgical motor programmed at 150rpm with a torque of 80 N/cm allowed drilling without irrigation with saline solution, without leading to overheating of the tissue; that avoid irrigation during the procedure stripping the tissue of the natural resources it uses to heal itself. In our case, the use of the surgical motor programmed at 150rpm with a torque of 80 N/cm allowed drilling without irrigation with saline solution, without leading to overheating of the tissue; that avoid irrigation during the procedure stripping the tissue of the natural resources it uses to heal itself.

At the 3 months (Fig. 6) and 6 months follow-up (Fig. 7), alveolar ridges with healthy tissue were evidenced. Panoramic x-rays were obtained and a correct osseointegration was observed, without associated radiolucent images or periimplantitis that could compromise the success of the dental implant, meeting the criteria of Albrektsson and Boronat(6). For this reason, we proceeded to the prosthetic phase. Also, a bone gain was observed above the implant, evidencing the success of the autologous graft obtained through the low-speed drilling technique. A removable total prosthesis for the maxilla, as it had an optimal alveolar rim, and an implant-muco supported prosthesis with ball attachments for the mandible were made.

One widespread practice used in conventional drilling techniques to avoid thermal damage is to apply saline solution to prevent the bit and the surrounding tissue from overheating(7,8). However, irrigating with saline solution could drag and dissolve low molecular weight proteins such as morphogenetic proteins, bone proteins, osteoinductor proteins, growth factors and other soluble substances whose function is to transmit activation messages to local cells so that they can react to stimuli such as those related to drilling(9). It would then be wise to opt for bone drilling techniques that avoid irritation during the procedure stripping the tissue of the natural resources it uses to heal itself. In our case, the use of the surgical motor programmed at 150rpm with a torque of 80 N/cm allowed drilling without irrigation with saline solution, without leading to overheating of the tissue; that avoid irrigation during the procedure stripping the tissue of the natural resources it uses to heal itself.

In 2007, Anitua et al. proposed a slow drilling speed technique for the
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preparation of the implant bed, which consists of a pilot drill rotating at 800rpm followed by bits with increasing diameters at 50rpm without irrigation. This technique allowed the collection of vital bone and did not harm bone healing. Furthermore, they did not find overheating at the tip of the drill bits with mean values of 28.1 ± 1.9 °C(10). These authors used a preparation rich in growth factors (PRGF), for the local application of bone graft material for the bone graft maturation; PRGF was mixed with the bone graft, and the platelet-rich fibrin matrix that develops subsequently confines the bone particles together, making its application and adaptation to the injured site easy.

In this investigation, the bone obtained was grafted onto the dental implants without the addition of any substance, differing from the protocol used by Anitua et al. where they mix the bone graft with PRGF, obtaining obvious benefits. However, in this research, satisfactory results were found to achieve a bone gain over implants placed, through a simplified technique that does not require the use of any additive in conjunction with the bone graft. Despite this, it would be interesting to delve into these modifications made to the original technique, leading to the establishment of protocols based on the evidence studied in the short, medium, and long term. The clinical importance of drilling at low revolutions is that the bone partially retains vitality and can be used alone or mixed with biomaterials in areas where guided bone regeneration or bone preservation is required, and could also be used to correct peri-implant defects or fill the space between bone and implant(11).

Another way to obtain autologous bone grafts is through bone traps. Several authors have compared bone particles obtained through these techniques. Bone trap design affects the mass and the nature of the collected tissue(12,13). The presence of microorganisms found during the collection process can be very high due to saliva retention with some bone defects around the implant. This is crucial for the improvement of the implant surgical technique. In our case, through this technique, a bone gain was obtained above the implants placed, evidenced clinically and radiographically evidenced at 6 postoperative months. This occurred in an atrophic mandibular alveolar ridge, which is generally considered a challenge in implant rehabilitation. There was no need for another surgical wound for grafting or the need of more expenses for the patient.

The use of autologous bone graft obtained through ultra-low-speed drilling and dental implants placed in the same surgical act can be considered a predictable treatment modality, being able to obtain up to 0.5 cc of bone for each implant bed (as in our case), but this amount of bone could vary according to the type of bone; this technique has high percentage of survival and imaging success, shortening the rehabilitation time and reducing the need for interventions, especially when an adequate case selection is also taken into account. Future research should be carried out to obtain greater scientific support for this technique.

CLINICAL RELEVANCE

Justification: Show the benefits and advantages of a technique with little use in the clinical practice of implant rehabilitation.

Results: Satisfactory results were obtained, the technique allowed obtaining an autologous bone graft without the need for another surgical wound, leading to adequate implant rehabilitation.

Practical consequences: The use of autologous bone graft obtained through ultra-low-speed drilling and dental implants placed in the same surgical act can be considered a predictable treatment modality, shortening the rehabilitation time and reducing the number of interventions. Being able to include edentulous patient care protocols.

CONFLICTS INTERESTS

The authors declare that they have no competing interests.

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