International journal of interdisciplinary dentistry
ISSN: 2452-5588
ISSN: 2452-5596
Sociedad de Periodoncia de Chile Implantología Rehabilitación Odontopediatria Ortodoncia

Bustamante, Gustavo; Vives, Francisco; Angulo, Claudia; Parra, Enmanuel
Ultra-slow drilling to obtain autologous bone graft in implantological rehabilitation. A forgotten technique with great advantages
International journal of interdisciplinary dentistry, vol. 14, no. 1, 2021, pp. 55-57
Sociedad de Periodoncia de Chile Implantología Rehabilitación Odontopediatria Ortodoncia

DOI: 10.4067/S2452-55882021000100055

CLINICAL REPORT

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

Gustavo Bustamante[1,2], Francisco Vives[3], Claudia Angulo[4], Enmanuel Parra[4*].

1. Aggregate Professor. Oral Surgery Post-Graduated Program. School of Dentistry. Universidad del Zulia. Venezuela.
2. Oral Surgeon. School of Dentistry. Universidad del Zulia. Venezuela.
3. Oral Prosthodontist. School of Dentistry. Universidad del Zulia. Venezuela.
4. Resident. Oral Surgery Post-Graduated Program. School of Dentistry. Universidad del Zulia, Venezuela.

**Corresponding author: Enmanuel David Parra | Address: Department of Oral and Maxillofacial Surgery. Dentistry Service. University Hospital of Maracaibo. 16th Avenue. Zulia, Venezuela. | Telephone number: +58 42 4203 6077 | E-mail: enmanuelparra04@gmail.com*
Work received on 03/05/2020.
Revised work 08/06/2020
Approved for publication on 12/07/2020

ABSTRACT

Osseointegrated implants are currently the prosthetic treatment by predilection in the oral cavity when dental organs have been lost. Bone deficiency interferes 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. The ultra-low speed drilling 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.

KEY WORDS:

Alveolar bone grafting; Autologous transplantation; Dental implants; Bone transplantation.

Int. J. Inter. Dent Vol. 14(1); 55-57, 2021.

INTRODUCTION

Osseointegrated implants are currently the prosthetic treatment by predilection in the oral cavity when dental organs have been lost(1) 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 point(2).

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 site(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 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(4).

This technique described in 1985 has abundant benefits and advantages(4), 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 maxillomandibular edentulism and with a type IV alveolar ridge according to the Cawood and Howell(5) 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 software® (4.6.2 version) for the placement of two 3.75x10mm dental implants (Smart IQ® implants) respecting adjacent anatomical structures.

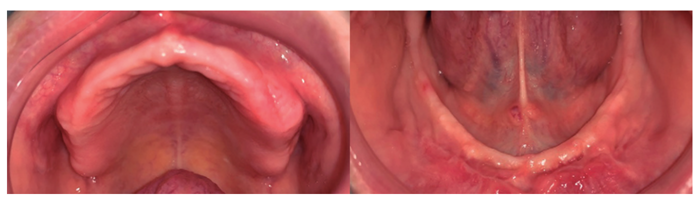

Figure 1. Alveolar maxilla-mandibular ridges edentulous.

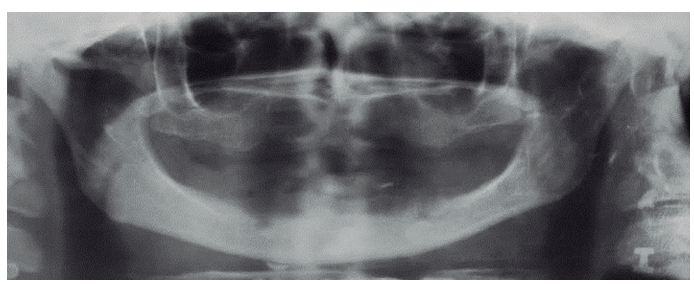

Figure 2. Initial panoramic X-ray.

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 Zarb(2) 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.

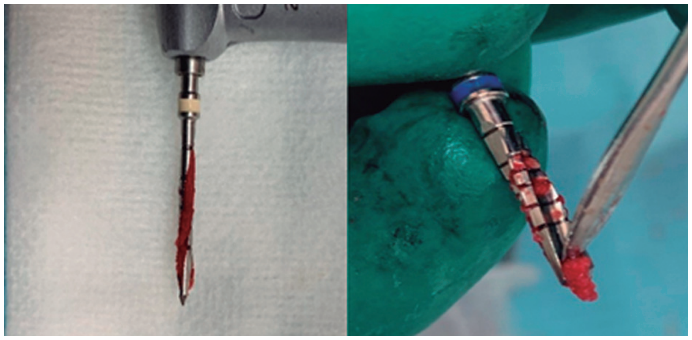

Figure 3. Obtaining autologous bone during the preparation of the implant receptor bed.

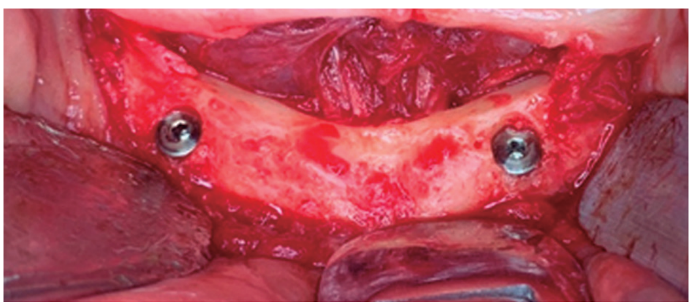

Figure 4. Placement of the implants in the prepared beds.

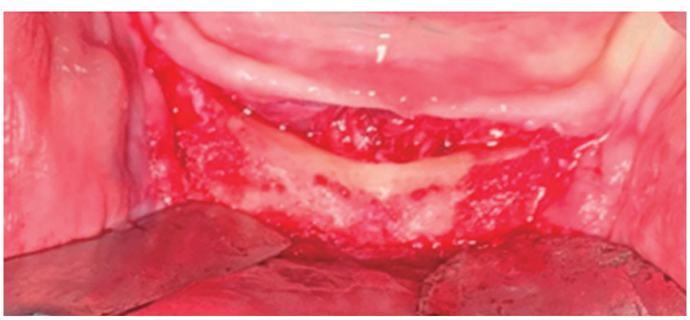

Figure 5. Coverage of endosseous implants with autologous bone obtained through ultra-low speed drilling.

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.

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

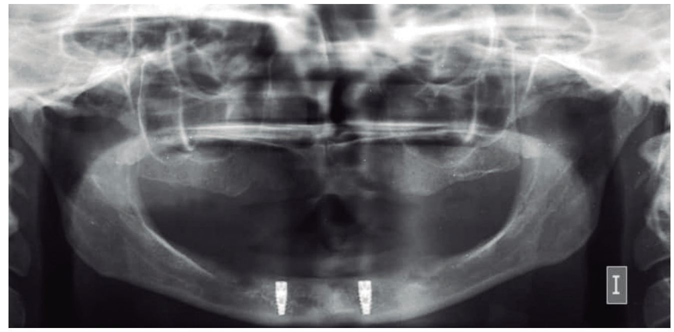

Figure 6. Panoramic X-ray at 3 postoperative months.

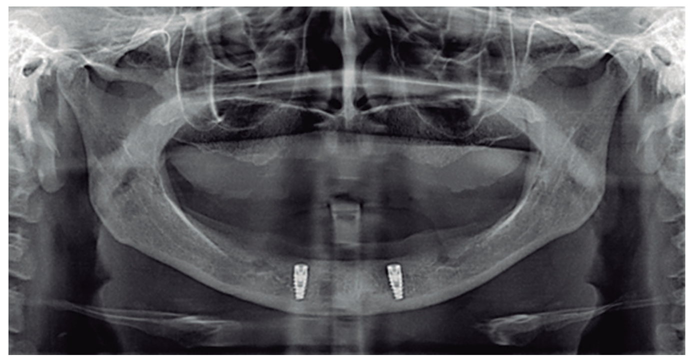

Figure 7. Panoramic X-ray at 6 postoperative months.

bone, facilitates the collection of autologous graft, eliminates the need to obtain bone from another surgical area, preserves cell viability and can decrease the patient's subjective feeling of suffocation[4]. Based on this long-studied evidence, techniques such as the one described in this case report emerge. The concept of ultra-low speed drilling presented in this investigation has been suggested as an alternative to the conventional procedure. It provides a method for obtaining autologous bone during the preparation of the surgical site, eliminating the need to collect bone from a second surgical area.

In our case, we use a speed of 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. Then, the surgical motor was programmed at 150rpm with a torque of 80N/cm, without irrigation. We use 150rpm without irrigation after the initial drilling (differing from the initial technique described by Driskell), this because in type I bones according to Lekholm and Zarb[2] (as in the case presented), the use of lower speeds can be an obstacle due to bone density.

Gaspar et al. in their research they state that excessively traumatic surgery can adversely affect the maturation of bone tissue and consequently diminish the predictability of osseointegration; the mechanical and thermal damage should be minimized during surgical procedure. One of the advantages of the concept of low-speed drilling without irrigation is to minimize trauma. This due to the easy control of the drilling path; During conventional high-speed drilling, there may be an unintentional deviation of the drilling path. Low-speed drilling can inform the operator more precisely that the path has changed so that the operator can correct it if necessary. Furthermore, the potential risk of damaging the inferior alveolar nerve or invading vital structures such as the maxillary sinus is minimized with this technique[1]. In our case, during ultra-low speed drilling, there was no thermal, mechanical damage, deviation of the drilling route for implant placement, or damage to adjacent structures.

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 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; avoiding the displacement of the aforementioned soluble molecules entrained in conventional techniques that have a crucial role in bone healing.

In 2007, Anitua et al. proposed a slow drilling speed technique for the 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. 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 traps[14]. However, the displaced tissue retained in the drill bit during low-speed drilling is very easy to collect, lessening saliva contamination; putting before the ultra-slow drilling technique like the one described in the present clinical case in terms of benefits.

Low-speed drilling without irrigation is particularly recommended when an autograft is indicated since it allows to collect the bone directly from the drill, reducing contamination by saliva. The bone particles collected by this method are larger and viable, with osteocytes and bone architecture maintained[1]. The amount of bone collected during the presented investigation (0.5cc) was easily obtained directly from the drill and allowed to cover the implants placed with the autograft without the need for another surgical wound to obtain them; resulting in a favorable formation of bone tissue above the implants.

This concept of drilling has been suggested as an alternative to the conventional procedure for obtaining autologous graft to rehabilitate small bone defects around the implant, eliminating the need to obtain bone from another area and avoiding another surgical wound[15]. In our case, there was no need for another surgical wound for grafting or the need of more expenses for the patient. We obtained 0,5cc of bone from the implant bed, but this amount could vary according to the type of bone. This amount of bone was used to cover the implants placed, reducing bone loss that can accompany the drilling technique for implant rehabilitation; improving osseointegration, and avoiding the exposure of the implants being submerged in bone tissue. This was evidenced radiographically and clinically.

Bone collected by this procedure is easier to manipulate than bone collected by other means and can provide adhesion due to the proteins involved in bone repair. In addition to the safety of this procedure, other additional advantages of drilling at low revolutions are the amount of autologous bone that can be recovered, the presence of vital cells within the bone, the possible reduction of stress in the patient and the reduction of costs and surgical time[10,15].

CONCLUSION

Autologous bone is the Gold Standard for filling bone defects due to its osteoinduction, osteoconduction, and osteogenesis properties. Techniques that allow its obtention, such as the ultra-slow drilling technique presented in this research, eliminate the disadvantage that comes with conventional procedures of using other donor areas to rehabilitate small 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 number of 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.

FUNDING

This research was carried out without funding.

ACKNOWLEDGEMENTS

We thank Dr. Salomon Ramos for his collaboration in the development of this research.

References

1. Gaspar J, Borrecho G, Oliveira P, Salvado F, Santos J. Osteotomy at low-speed drilling without irrigation versus high-speed drilling with irrigation: an experimental study. Acta Med Port. 2013 May-Jun;26(3):231-236.
2. Ucer C. A Dentist's Guide to Implantology. Asociation of Dental Implantology. 2012.
3. Moussa NT, Dym H. Maxillofacial bone grafting materials. Dent Clin North Am. 2020 Apr;64(2):473-490.
4. Esquiaga García H. Velocidad ultralenta en implantología. Gaceta Dental. 2008 oct;(196):182-189.
5. Cawood JI, Howell RA. A classification of the edentulous jaws. Int J Oral Maxillofac Surg. 1988 Aug;17(4):232-6.
6. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants. 1986;1(1):11-25.
7. Benington IC, Biagioni PA, Crossey PJ, Hussey DL, Sheridan S, Lamey PJ. Temperature changes in bovine mandibular bone during implant site preparation: An assessment using infrared thermography. J Dent 1996; 24:263–267.
8. Benington IC, Biagioni PA, Briggs J, Sheridan S, Lamey PJ.Thermal changes observed at implant sites during internal and external irrigation. Clin Oral Implants Res 2002; 13:293-297.
9. Groeneveld EH, Burger EH. Bone morphogenetic proteins in human bone regeneration. Eur J Endocrinol. 2000 Jan;142(1):9-21.
10. Anitua E, Carda C, Andia I. A novel drilling procedure and subsequent bone autograft preparation: A technical note. Int J Oral Maxillofac Implants. 2007 Jan-Feb;22(1):138-45.
11. Wiltfang J, Kloss FR, Kessler P, Nkenke E, Schultze-Mosgau S, Zimmermann R, Schlegel KA. Effects of platelet-rich plasma on bone healing in combination with autogenous bone and bone substitutes in critical-size defects. An animal experiment. Clin Oral Implants Res. 2004 Apr;15(2):187-93.
12. Blay A, Tunchel S, Sendyk WR. Viability of autogenous bone grafts obtained by using bone collectors: Histological and microbiological study. Pesqui Odontol Bras 2003;17:234–240.
13. Kainulainen V, Oikarinen K. Comparison of bone collectors designed for oral and maxillofacial surgery: An in vitro study. Clin Oral Implants Res. 1998:9:327-332.
14. Young MPJ, Worthington HV, Lloyd RE, Drucker DB, Sloan P, Carter DH. Bone collected during dental implant surgery: A clinical and histological study. Clin Oral Implants Res 2002;13:298-303.
15. Giro G, Tovar N, Marin C, Bonfante EA, Jimbo R, Suzuki M, et al. The Effect of simplifying dental implant drilling sequence on osseointegration: An experimental study in dogs. Int J Biomater. 2013 Jan; 2013:230310.