Innovated approach in late failure of osseointegrated implant: Minimally traumatic implant explantation (Part 1)

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Abstract

Introduction: The minimally traumatic retrieval implant technique is a treatment that uses a tapered screw counterclockwise device. This tool can break the osseointegration and retrieve the implant easily. **Objective:** The aim of this paper is to show a clinical case report where this technique was used in implant failure and to show the advantages and disadvantages of other treatment alternatives. **Conclusions:** This new approach suggests that this explantation can preserve the peri-implant bone tissue and the adjacent teeth, there is a reduction of treatment time and in the morbidity associated with bone reconstruction. It seems an effective technique for removal of implants, ensuring predictability to retreatment.

Keywords: Dental implants. Retreatment. Device removal.

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Introduction

Implant-supported restorations provide a predictable tooth replacement treatment because success rates are high.[1] However, failures can occur in implant treatments.[2,3] For adequate management and retreatment is necessary to identify the causing factor of the failure, to try to fix it with a different approach.

Late failures occur after total or partial osseointegration of the implant surface subjected to occlusal load[4] and jeopardize patient satisfaction and aesthetic function.[5] Among the causes are peri-implantitis, occlusal overload,[3] prosthetic problems, inadequate three-dimensional positioning of the implant and deficient tissue volume that was previously uncorrected.

The treatment selection comes with a difficult decision: maintaining the implant or not. For a long time the maintenance of the implant was the first option of treatment, since the implant retrieve with late failure is complicated and traumatic, can lead to consequences that jeopardize the function and esthetic results.[6]

Broadly used in histological research to obtain *in vivo* samples, the trephine drill is also used in explantation in a peri-implant bone-wear technique.[7] The drawbacks of this technique are the excessive bone wear, which may put in risk the adjacent teeth, leading to further required bone grafting; difficulty in cooling the drill, and causing overheating bone necrosis; and the increased time for the rehabilitation of the supported implant, due to waiting for the bone healing after grafting.

Nowadays there is a dental device which disrupts the osseointegration, unscrewing the implant with or without minimal bone damage.[6] It consists of a conical screw counterclockwise which connects inside of the implant, and when rotated, with the aid of a ratchet, attaches to the implant, removing easily with minimal trauma.

The aim of this article is to discuss different treatment options in late failure implants, showing the advantages, disadvantages, indications and contraindications of each technique, and present a new treatment option: a minimally traumatic explantation.

Case report

Male patient came to private clinic with complaints about the aesthetic result of previous treatments (Fig 1). The patient was partially edentulous, with chronic periodontitis and had an implant crown in the region of tooth 21, where there was great loss of vestibular tissue volume. The periodontal biotype was intermediate and smile line was average. Peri-implant bone loss was observed, radiographically and tomographically, (Fig 2 and 3) in the region of 21. There was no spontaneous bleeding or oozing in this area.

This patient began treatment with periodontal therapy. Old restorations were removed and provisional crowns were made in an attempt to provide an esthetic result that would satisfy the initial aspirations of the patient (Fig 4). The crown on the implant of 21 was removed, in an attempt to cover it with soft tissue for

Figure 1 - Clinical case initial image.

a period of three weeks. After concluding this set of provisional crowns, a great deficiency of previously uncorrected soft tissue, the presence of a large space between the roots of the 11 and 22 and the gingival level variation of teeth 11, 22 and 23 were observed in the region of the implant (Fig 5-7).

We decided to restore the ideal gingival contour with a clinical crown augmentation surgery followed by an implant removal in the region of tooth 21 with simultaneous alveolar bone regeneration and the correction of the tissue deficiency with connective submucosal tissue graft.

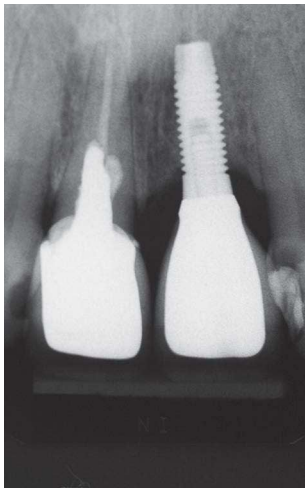

Figure 2 - Radiographic and tomographic initial images of the clinical case.

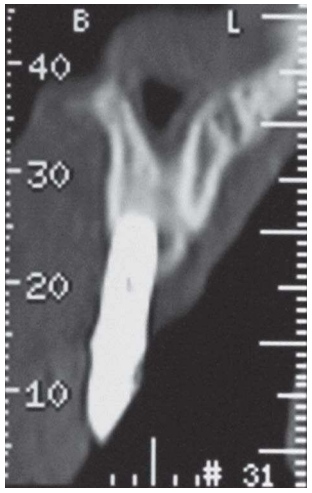

Figure 3 - Radiographic and tomographic initial images of the clinical case.

Figure 4 - Clinical case after the provisional crowns.

Figure 5 - It can be observed the large deficiency in the implanted tissue, the presence of a wide diameter between teeth 11 and 22 and the gingival ideal level variation of teeth 11, 22, and 23.

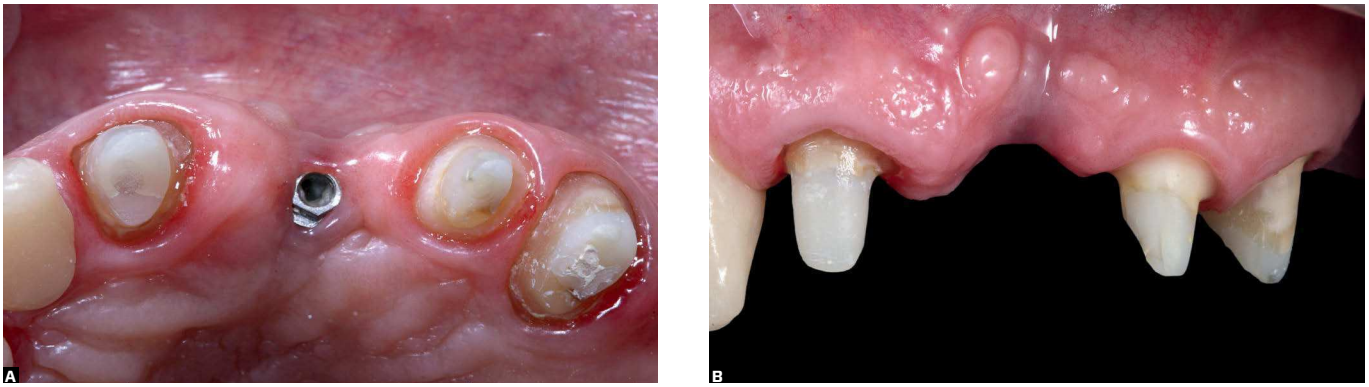

Figure 6 - Again, it can be observed the large deficiency in the implanted tissue, the presence of a wide diameter between teeth 11 and 22 and the gingival ideal level variation of teeth 11, 22, and 23.

In an attempt to decrease the cost, time and number of interventions in the treatment of the patient, primarily, we tried to accomplish the minimally traumatic explantation. If this procedure fails, a conventional procedure would be performed with drills, trephines and forceps.

Intrasulcular incisions followed by internal bevel incisions were made to remove the excess of gingival tissue (Fig 8 and 9) and flapless osteotomy was performed in the adjacent teeth of the implant with provisional crowns in place. A supracrestal incision mildly shifted toward the palate was held between the dihedral angles of the teeth 11 and 22 (Fig 10). The flap was folded, making ideal conditions for visualization of the implant (Fig 11). The conical retrieval was inserted into the implant screwing it in a counterclockwise direction, and this set was connected to the ratchet. Counter-torques are given in the ratchet until it breaks osseointegration and enable the implant to be removed progressively (Fig 12, 13 and 14).

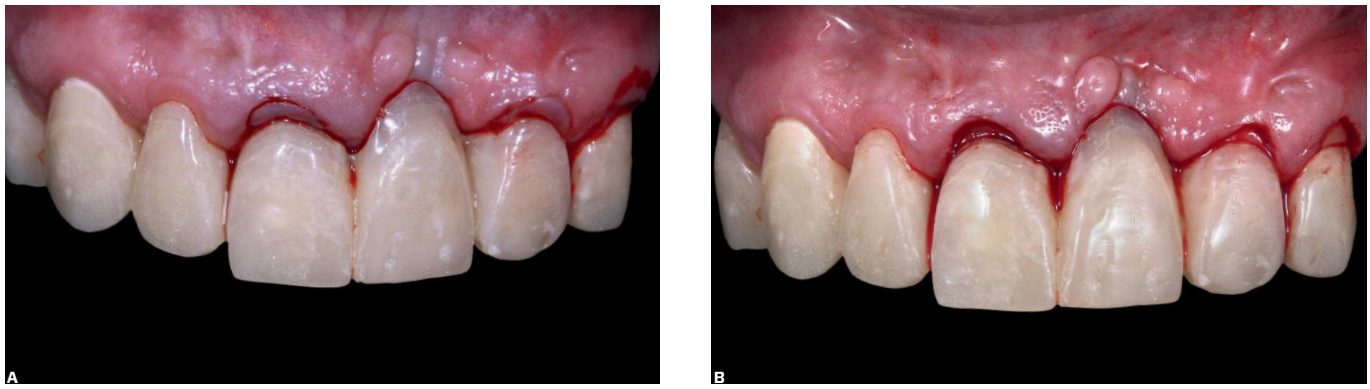

Figure 7 - Incisions for removing excess gingival tissue.

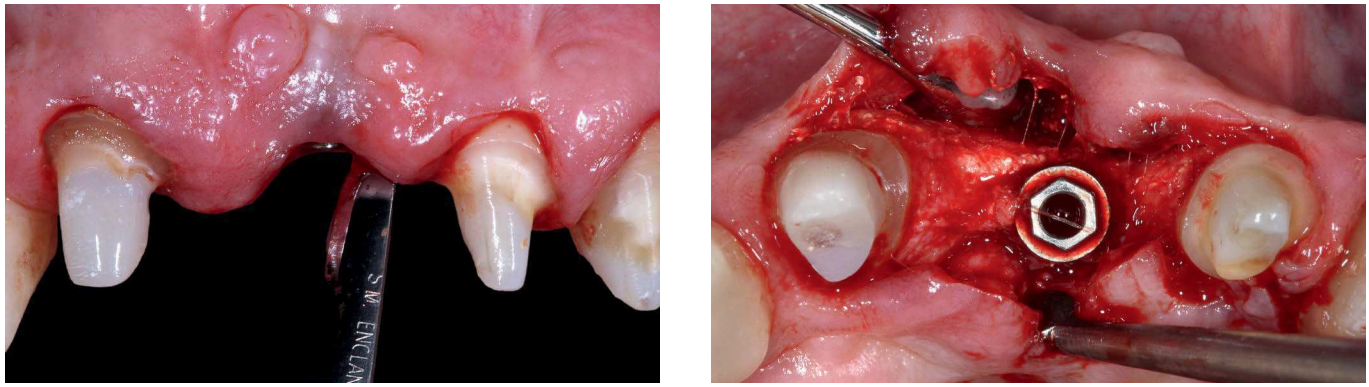

Figure 8 - Supracrestal incision slightly palatal shifted.

Figure 9 - Occlusal view after flap folding.

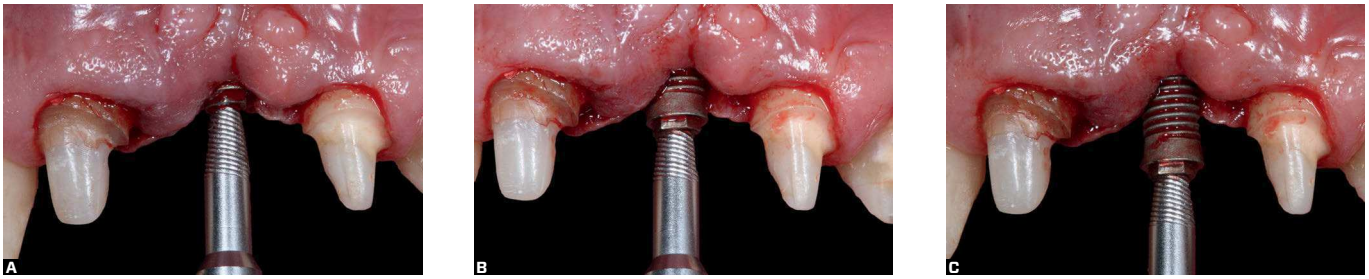

Figure 10 - Implant gradually being removed. Note the opposite direction of the tapered threads remover compared to the implant.

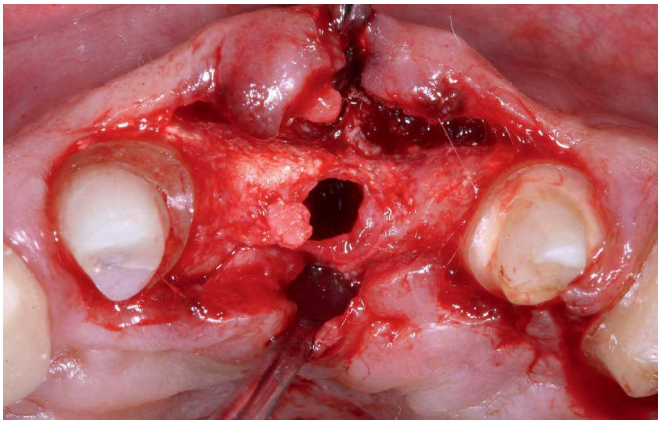

Figure 11 - Occlusal view of the alveolus after explantation.

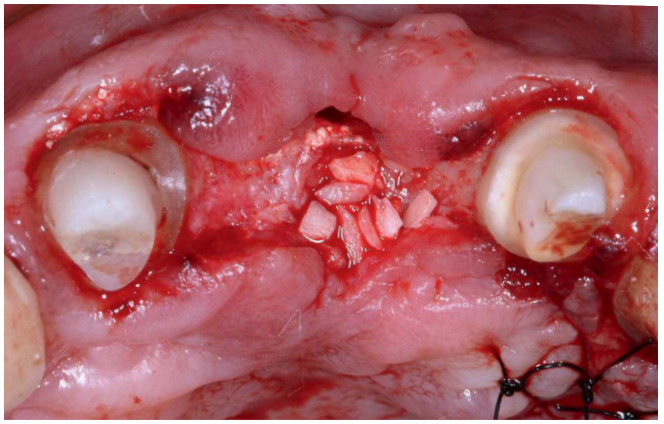

Figure 12 - Alveolus filling with biomaterial.

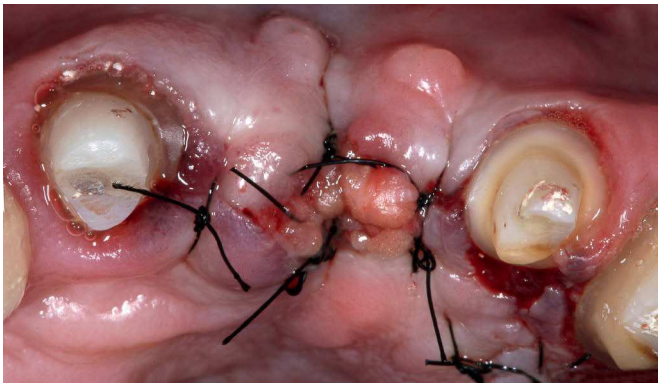

Figure 13 - Suture after covering with a connective tissue graft.

Figure 14 - Provisional crowns repositioned and recemented.

After removal of the implant (Fig 15) we inspected the integrity of the alveolus. It was filled with a slow resorption biomaterial Bio-Oss® and then a subepithelial connective tissue graft was performed, transplanted from the palate, under the flap from the buccal surface to the cervical ridge, stabilized by sutures (Fig 16 and 17). Then the crowns were relieved in the bridge, repositioned and cemented (Fig 18). A new procedure should be performed in 8 months after complete healing and remodeling of the bone tissue.

Bibliographic review and discussion

There are many options to treat late failures in Implantology. Each technique have its directions, advantages and disadvantages. These are described below and related to the clinical case reported.

Treatment options with the maintenance of the implant

Using an implant prosthesis

Dental-gingival prosthesis

The offsetting of soft tissue in an implant prosthesis[8,9] is indicated in cases of advanced uncorrected tissue deficiencies, preferably in multiple implants, and patients resistant to surgical treatment options. This artifice allows a balance of form and height / width ratio, dental papilla to be at an ideal height, a correct dental axis, sealing of air during speech, smile line and optimal gain of lip support in cases of severe tissue defects. The limitations of the technique are the height of the smile, the tissue conditioning to correct emergence profile and maintenance of oral hygiene. There is the need for strict control of plaque by the patient and due to this factor was not opted for this alternative treatment in the clinical case reported. There is the need for strict control of plaque by the patient and due to this factor, this treatment option was not choice for the clinical case reported.

Connective tissue graft associated with techniques

The subepithelial connective tissue graft[10] is a surgical technique that emerged from the periodontal plastic surgery in order to recover roots on exposed areas and / or form a band of keratinized tissue where there is an absence. In the Implantology this technique may be employed before, during or after implantation, and may be performed in more than one surgical approach. The best donor region is the palatal mucosa and the technique of choice with less postoperative discomfort is the technique of linear incision with suspended sutures, which reduces the risk of bleeding and enhances the healing process. In late failure implants, this technique is recommended in situations where there are minor tissue deficiencies that were previously uncorrected and exposure of a few implant threads, provided that they are decontaminated and that the implant has proper tridimensional placement.[11,12] The tissue defects presented in our case made it impossible to use the implant, but the subepithelial tissues graft allowed greater gain in vestibular thickness for future reimplant in the region.

Temporary submerged-implant

The submerged-root is a technique that emerged because of the impossibility to use prosthetical disabled teeth.[13,14] The extraction of these teeth would lead to vestibular bone resorption and loss of tissue volume; the submerged-root technique preserves the tissue volume in that area. Temporary submerged-implant technique promotes a gain of soft tissue in the regions of implant exposure and may be associated with subepithelial connective tissue grafting techniques. It is recommended to recover in case of exposure of the platform and / or the threads of the implant, tissue deficiencies, or peri-implantitis. However the technique is contraindicated in cases where there is no decontamination of the threads. In the clinical case described, the temporary submerged-implant could be performed in order to be able to recover the implant platform with soft tissue, since the biomaterial Bio-Oss® was placed in the alveolus after explantation and this would not be exposed to the oral cavity.

Surgical relocation

This technique is indicated in cases of incorrectly positioned implants with great prosthetical limitations without the presence of peri-implantitis. It consists of removing and repositioning of the implant bone block and can be performed with drills, chisels and / or piezosonic scalpel.[15,16] This last offers lower post-surgical trauma, because it does not generate osseous heat and performs a more delicate osteotomy. The limitations of the technique are the risk of slicing the adjacent dental roots,

the difficulty in fixing the block and poor access (in some cases). Because of the difficulty of the technique, it has become a less used option. This technique has not been shown in this case because there was peri-implant bone loss.

Surgical peri-implantitis regeneration therapy

Some studies indicate the possibility of a regenerative surgery, and even re-osseointegration, in implants disabled by peri-implantitis. Despite being a recent issue, the etiology of periodontal disease and peri-implant disease are similar, but the second has much more rapid progression due the absence of the periodontal ligament and the difficulty of complete decontamination of screw threads. The main objective of the technique is decontamination and the filing of the implant threads with drills and ultrasonic instruments.[18,19] Antiseptic solutions, topical antibiotics may be used, along with, in some cases, grafts and biomaterials for covering bone defects. It is indicated only in cases of well positioned long implants, with a maximum of one third of the height jeopardized of the bone loss, and / or supporting extensive prosthetic rehabilitation. Because of the large bone loss around the implant, difficulty of the technique and high cost, this alternative treatment has not been ruled out for this clinical case.

Without using an implant prosthesis

Permanent submerged-implant

The implant failure may lead the patient to frustration regarding surgical approaches and so prosthetic conventional treatments can be a solution in such cases. In regions that the adjacent teeth are present, conventional fixed prostheses or adhesive prostheses[3] are two options, with or without association of a connective tissue graft to correct defects in the volume of the pontic area. Due to the need for a surgical procedure, like clinical crown lengthening surgery in the adjacent teeth, and by the choice of the patient, this technique was not chosen.

Treatment options without implant maintenance

Implant removal

Traumatic techniques of explantation

Many times late implant failures render impossible prosthetic rehabilitation with adequate function / esthetic, and thus, the removal of dental implants becomes a required solution. However, conventional techniques of explantation are traumatics[7] because peri-implant bone tissue is unnecessarily filed. For this reason this kind of procedure becomes the last treatment choice in cases of failure.

Carbide and trephine drill (Fig 19) produce bone heating due the difficulty of cooling and induce necrosis after surgery, remove unnecessary peri-implantar bone tissue and create a risk of injury to the adjacent roots. Conventional instruments of exodontia technique, such as root elevators, tooth forceps and bone rongeurs, have a limited efficiency in the removal of dental implants. Those boorish instruments can injure the buccal peri-implantar bone wall. Recently an electrosurgical device for implant remove emerged[20] to make the approach easier. However, this procedure causes thermal necrosis and indicates high peri-implantar bone trauma. Piezosonic scalpel can be used in this technique too, but it leads to unnecessary removal of the peri-implantar bone also.

Minimally traumatic technique of explantation.

The minimally traumatic implant removal appeared to make the explantation easier.[6,21] The conventional approach can lead to a clinical case with additional reconstructive procedures, delayed healing, damage to adjacent teeth, complex operation, high costs and risk of impossibility of future reimplantation in the same area. Being a high-risk technique, it has turned into the last treatment option or even ruled out of the question.

The explantation by counterclockwise torque was used[22] to evaluate in rabbits the implant osseointegration

with different surface treatments. Another study[23] evaluated *in vivo* the amount of torque required to remove orthodontic mini implants with surface treatment. They concluded the removal torque was 67.91 ± 12.47 N and varied according the implanted area.

As described in recent literature,[6] there emerged in the dental market a counterclockwise threaded conical device (Fig 20), which by imbrication with the implant's inner surface, and connected to a ratchet, can transfer the torque load from the ratchet to the implant, breaking the osseointegration and easily unscrewing the implant (Fig 21). The need for tissue reconstruction is reduced because it causes less trauma and does not need to remove periimplantar bone, which would lead to less time for a new reimplantation or even immediated reimplantation after the explantation.

Figure 15 - Trephine drills of different diameters.

Figure 16 - Tapered removers available in the dental market of the brands: Nobel Biocare (Zurich, Switzerland), Kopp (Curitiba, Brazil) and Maximus (Contagem, Brazil), from left to right, respectively.

Figure 17 - Dental implant explanted with the conical remover.

Figure 18 - Tapered remover used in mechanical removal of screws.

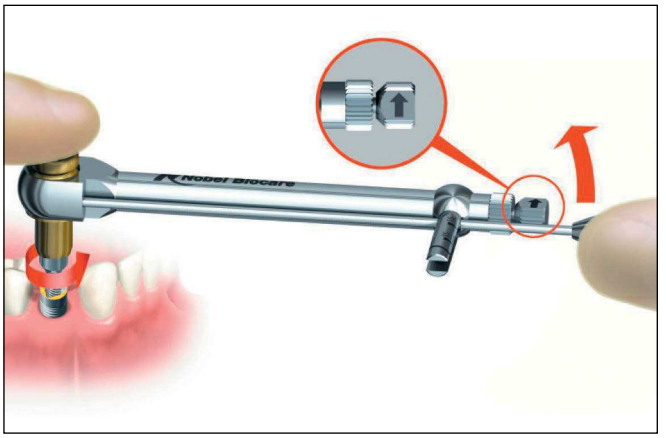

Figure 19 - Dental implant being unscrewed from the tapered ratchet remover by means of counterclockwise torque (image courtesy of Nobel Biocare Services AG).

Another article[21] reports the use of a implant remove kit with the conical tool and trephine drills to cervical osteotomy. It was observed that when used, it decreases the necessary torque required for removal, and it is in the range of 80-200N.

The tapered remover works from a mechanical principle and is widely diffused in the mechanics for the removal of broken screws (Fig 22).

The sequence suggested by the authors to use the tapered device is:

1) Widening the internal implant hole – aiming to establish better positioning of the tapering tool in the implant and avoid fracturing of the part caused by partial or improper settling.
2) Osteotomy in switching platform implant – this type of implant may have a accommodation of bone tissue in the cervical area and platform of the implant, which can enhance the stress generated in the remove and hinder it.
3) Attach the removal device in the implant – this should be done by threading the tool in a counterclockwise direction, being careful to stabilize it on the same axis of the implant.
4) Snap on the removal device with ratchet – a ratchet, in good condition, with a counterclockwise orientation must be used, so that there is no damage to internal components, as the torque can reach 200N.
5) Rotate the set in a counter-clockwise direction – the removal tool is progressively locked inside the implant until it is stabilized by the increased resistance.
6) Load the ratchet until it breaks osseointegration – this force varies according to the implanted area and the implant surface treatment. The ratchet must be stabilized with your fingers against the implant (Fig 23) because at this point a fracture risk arises.
7) Unscrewing the implant – which is easily removed.
8) Inspection of explanted area – the integrity of the alveolus bone walls are assessed, which will guide the decision to do an immediate reimplantation, an early reimplantation or a delayed reimplantation that can be performed at this time, following the bone graft.

In this suggested sequence we observe that we can perform a flapless surgery. In this clinical case we chosen by flap the mucosa, since there was a previous osteotomy and needed to grafting after explantation. We could have a direct visual inspection of the peri-implant bone walls with the flap approach. After the period of bone remodeling, approximately 8 months due to the use of biomaterial,[24] a new, more apical and shifted toward the palate implant will be installed.

In clinical cases of unaltered bone walls and with adequate height and thickness, we suggest that reimplantation may be performed subsequent to the minimally traumatic explantation surgery, which would decrease even more time and costs to prosthetic rehabilitation treatment. In the clinical case described, the bone walls were thin and we chose to fill the socket after explantation with Bio-Oss® biomaterial, and at the same time performed a subepithelial connective tissue graft. The proposed to use is a xenogenic biomaterial in order to reduce the buccal bone wall resorption, as occurs in cases of sockets after exodontia. However we can not say that the behavior of sockets after explantation is equals the sockets after dental extraction, which suggests further studies on this subject.

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