# Immediate Dentoalveolar Restoration of compromised sockets: a novel technique

**José Carlos Martins da Rosa**
Specialist in Periodontics, São Paulo Association of Dental Surgeons, Bauru, São Paulo, Brazil
MSc in Prosthetics, São Leopoldo Mandic Dental Research Center, Campinas, São Paulo, Brazil
PhD Student in Oral Implantology, São Leopoldo Mandic Dental Research Center, Campinas, São Paulo, Brazil

**Ariádene Cristina Pértile de Oliveira Rosa**
Specialist in Implant Dentistry, São Leopoldo Mandic Dental Research Center, Campinas, São Paulo, Brazil
Specialist in Acupuncture, Brazilian College of Systemic Studies, CBES, Porto Alegre, Rio Grande de Sul, Brazil
MSc Student in Oral Implantology, São Leopoldo Mandic Dental Research Center, Campinas, São Paulo, Brazil

**Darcymar Martins da Rosa**
Specialist in Prosthetics, Pontifical Catholic University, Porto Alegre, Rio Grande de Sul, Brazil
Specialist in Oral Implantology, Pontifical Catholic University, Campinas, São Paulo, Brazil

**Carla Mônica Zardo**
Specialist in Orthodontics and Facial Orthopedics, HRAC, University of São Paulo, Bauru, São Paulo SP, Brazil
MSc Student in Oral Implantology, São Leopoldo Mandic Dental Research Center, Campinas, São Paulo, Brazil

Correspondence to: José Carlos Martins da Rosa
Av. São Leopoldo 680 – CEP 95097-350 – Caxias do Sul, Rio Grande do Sul, Brazil;
Tel: +55 54 99711313; E-mail: josecarlos@rosaodontologia.com.br

## Abstract

*Purpose:* The aim of this paper is to describe a protocol for a one-stage technique called Immediate Dentoalveolar Restoration (IDR), which uses autogenous bone grafts to restore peri-implant bone defects, presenting the results of mid-term follow-up.

*Summary:* The patient presented a left central incisor that was compromised and with a total loss of buccal bone wall. The proposed treatment followed a protocol of immediate implantation, with a flapless surgery, using corticocancellous bone graft harvested from the maxillary tuberosity to restore the bone defect in question. The graft was shaped to the defect size and inserted between the implant and the remaining buccal soft tissue. The provisional restoration was made at the same time. The patient was followed for 36 months. The results were analyzed by means of clinical assessment, photography, periapical radiography and cone beam computed tomography.

*Conclusion:* The treatment described appears to afford satisfactory esthetic results, with lower overall costs and treatment time.

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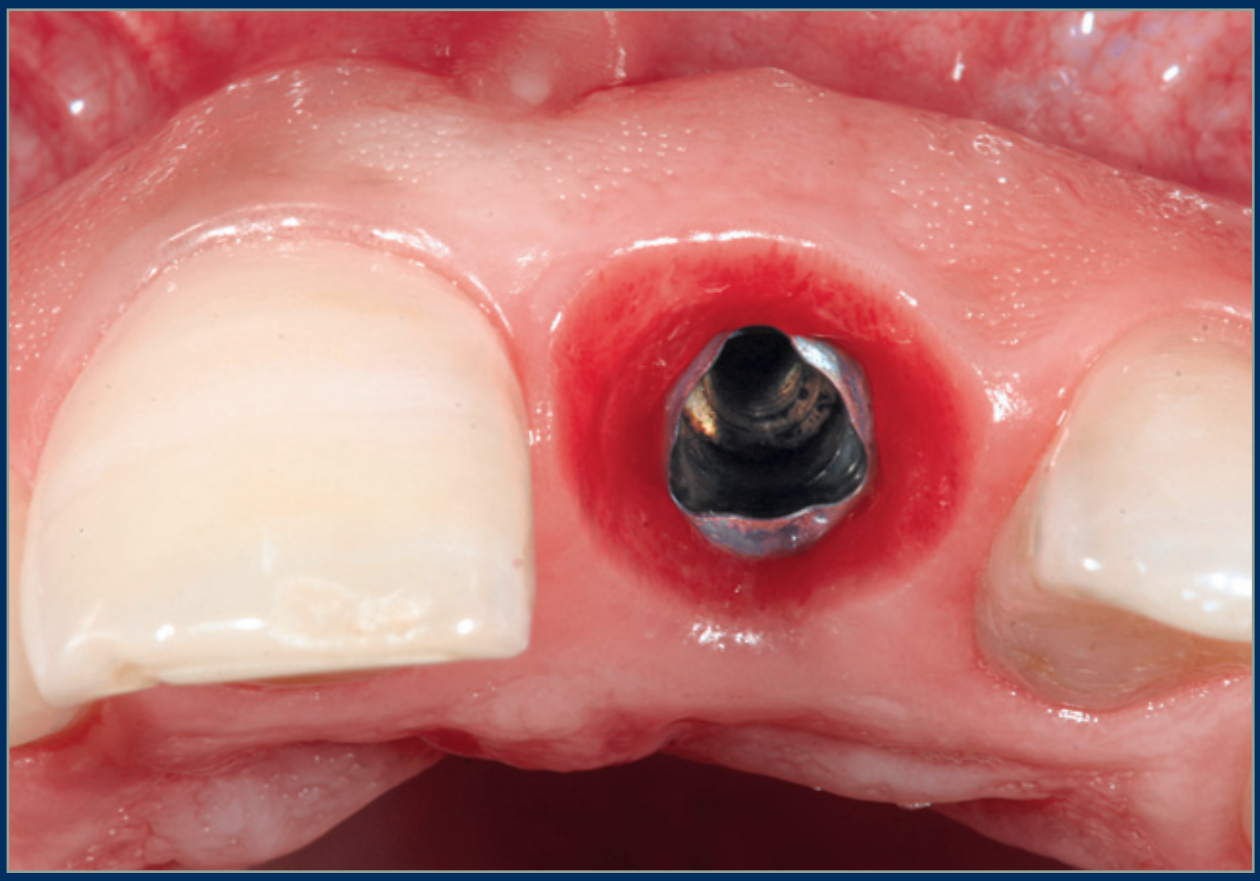


## Introduction

Immediate implantation and provisionalization requires the maintenance of the supporting tissues during dental extraction procedures.[1-4] Nevertheless, implant placement in a fresh extraction socket is often associated with the presence of peri-implant defects at the time of surgery.

Several procedures have been proposed to reestablish the compromised gingival and alveolar bone architecture, such as orthodontic forced eruption,[5,6] Guided Bone Regeneration (GBR),[7-11] and block bone graft with or without subepithelial connective tissue grafts.[12,13] All of these treatments can be used to treat bone defects before, during, or after tooth removal, in two or three surgical stages. However, the possibility of reconstruction through grafting and immediate restoration in a single operation has not been supported by several clinical studies.

We propose that these cases could be successfully treated using a technique that allows dental extraction, implantation and provisionalization to occur in the same procedure as the flapless bone reconstruction.

The aim of this paper is to report results from a mid-term follow-up of a clinical case in which dental implantation and immediate provisionalization in a compromised fresh socket was performed, describing a technique that we refer to as Immediate Dentoalveolar Restoration (IDR). This technique uses corticocancellous bone grafts harvested from the maxillary tuberosity to restore peri-implant bone defects at the same procedure and can be used in postextraction sites with minimal or severe loss of bone walls.

## Report

The initial clinical situation showed by a 24-year-old man, was pain and mobility in the left central incisor region (Fig 1). The starting point was a correct diagnosis for tooth extraction. The probing depth was 10 mm and the cone beam computerized tomography (CBCT) cross-sectional image showed a total loss of buccal bone wall (Fig 2). After the necessity of tooth extraction was confirmed, the patient was properly informed about the procedures to be performed and signed written consent forms. Thereafter, the proposed treatment followed an IDR protocol.

Antibiotic therapy (amoxicillin, 1 g) was administered two hours before the procedure. Antibiotic doses (amoxicillin, 500 mg) were continued for 7 days, 3 times per day.

The remaining alveolar bone was evaluated by CBCT, with the purpose of planning the anchoring of the implant. Likewise, the bone availability of the maxillary tuberosity was ascertained by visual inspection, digital palpation, panoramic radiography and CBCT.

For the extraction, an intrasulcular incision was made around the tooth using a microsurgical blade (SM69, Swann-Morton). Periotomes and microlevers were used to execute a minimally invasive dental extraction procedure (Fig 3). The buccal bone loss was confirmed (Fig 4).

Afterward, careful curettage of the socket to remove the granulation tissue and the remains of the periodontal connective tissue was performed.

A NobelReplace™ Tapered TiUnite® implant (Nobel Biocare) was installed.

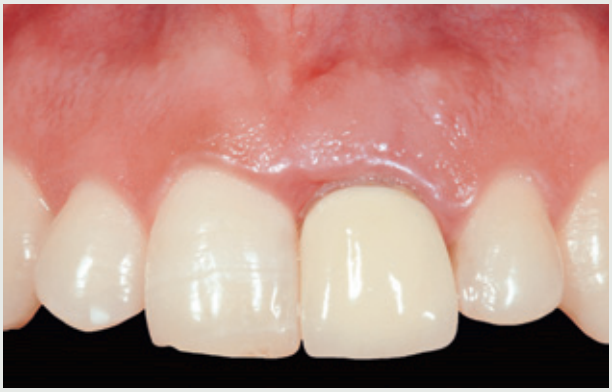


**Fig 1** Initial clinical assessment of the compromised left central incisor.

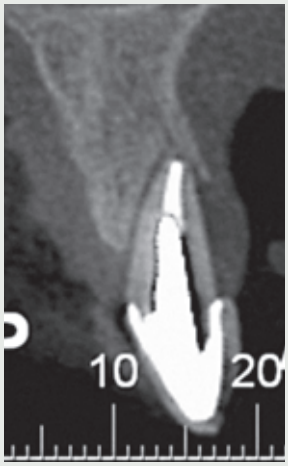



**Fig 2** Total loss of buccal bone wall as observed by cone beam computerized tomography.

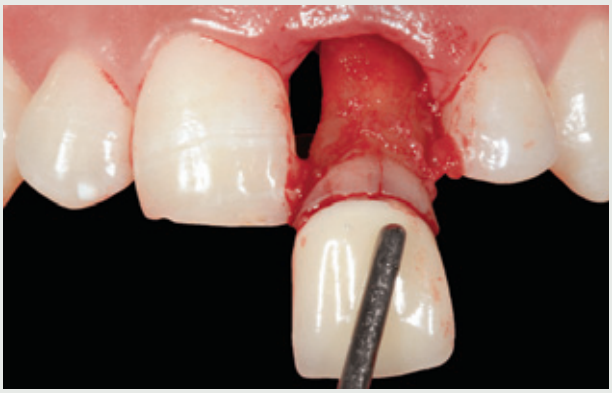


**Fig 3** The root fracture could be seen after the minimally invasive dental extraction procedure.

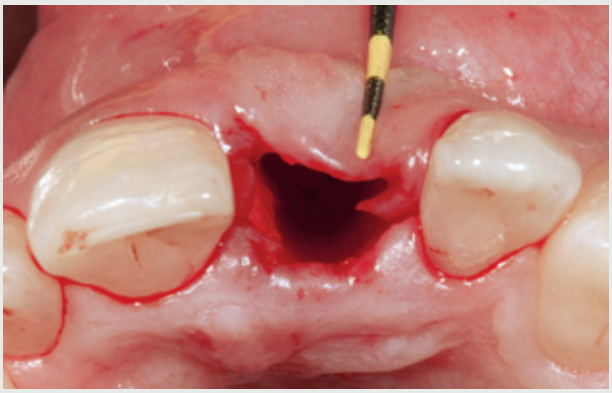


**Fig 4** Absence of buccal bone wall confirmed after dental extraction.

The final insertion torque was 50 Ncm. The implant was placed by means of a palatal approach with ideal three-dimensional positioning. The implant platform was inserted 3 mm apically of the gingival margin (Fig 5).

A provisional crown was constructed, establishing the ideal emergence profile to allow for the accommodation of the soft tissues and to promote a thicker and more stable margin of gingival tissue. In addition, the provisional crown was made out of occlusion. All steps of the provisionalization were performed

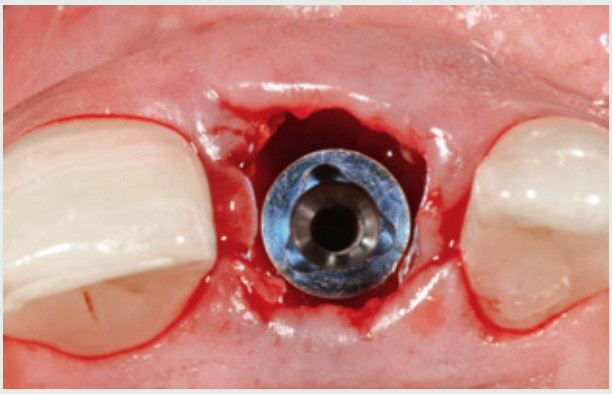
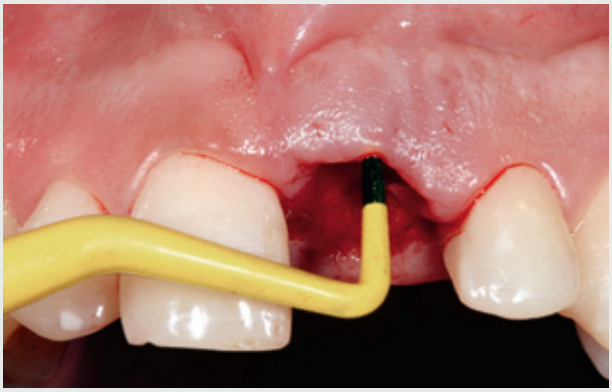
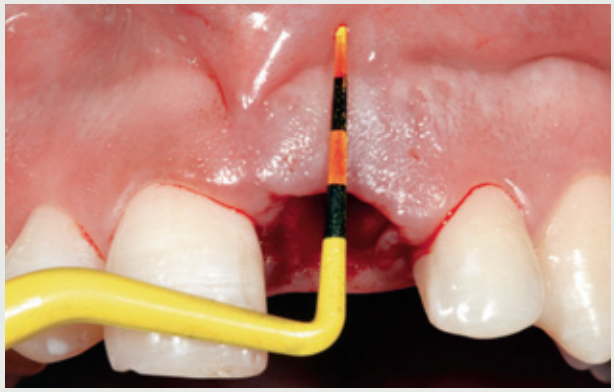


**Fig 5** The implant was installed with palatal anchorage and with a 3 mm distance between implant platform and gingival margin (NobelReplace™ Tapered TiUnite® implant, 16 mm X 5.0 mm).





**Figs 6 and 7** Measurement of the degree of alveolar bone loss by probing the socket walls.

before bone graft procedures so as to not risk contaminating the graft while handling the materials used to construct the crown.

Next, the degree of alveolar bone loss was measured. The socket walls were probed in the apical-coronal and mesial-distal directions to assess the degree of bone damage and to verify the anatomical shape of the defect (Figs 6 and 7). These measurements were transferred to the external gingival aspect, providing a simulation of the affected area (Fig 8).

After applying anesthesia to the maxillary tuberosity, an incision was made in order to access the donor area. Due to the presence of the third molar, a releasing incision was needed and a straight chisel (Schwert, Seitingen-Oberflacht, Germany) was used to harvest the corticocancellous graft from the lateral portion of the tuberosity (Fig 9). Bone marrow was also harvested from the donor region to fill the remaining spaces between the implant and the corticomedullary graft.

Manipulation of the corticomedullary graft was carried out using a rongeur to reproduce the shape of the peri-implant bone defect (Fig 10). This manipulation was performed quickly to maintain the vitality of the graft.

Next, the corticocancellous bone graft was inserted to the level of the implant platform, with the cortex turned toward the soft tissues (Figs 11 and 12). The stabilization of the corticocancellous bone was achieved at the time of insertion, since the graft was modeled to adequately fit the defect dimensions. Subsequently, the particulate bone marrow was inserted and compacted between the medullar portion of the corticocancellous graft and the surface of the implant (Fig 13). This condensation was made in small increments, from an apical to a cervical direction, with delicate instruments, taking care to avoid graft dislocation. A small bone compactor (Schwert) was used in the apical region and a larger diameter bone compactor was used in the coronal defect area.

Lastly, the provisional crown was reinstalled to seal the gingival margin (Figs 14 and 15). Torque (20 Ncm)

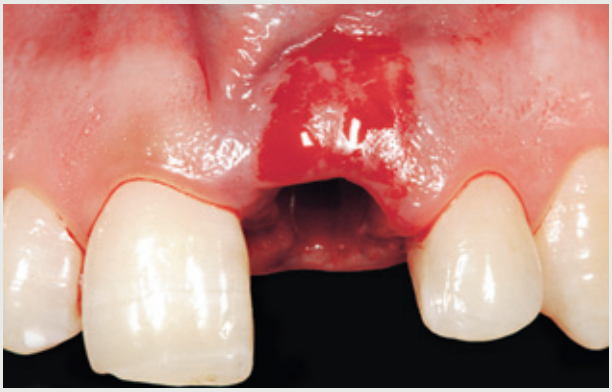


**Fig 8** The area to be reconstructed was "outlined" at the soft tissue region using blood from the alveolar socket.

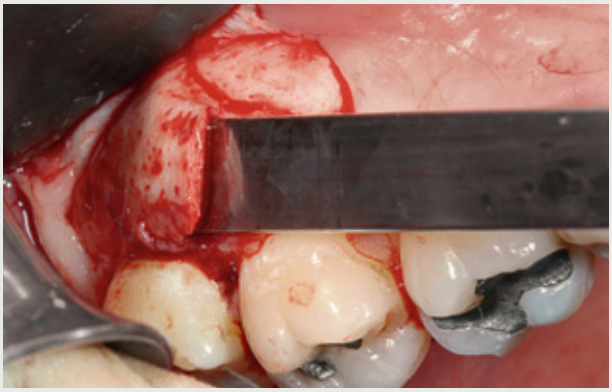


**Fig 9** Bone graft being harvested from the lateral portion of the maxillary tuberosity using an straight chisel.

was applied to the attachment screw of the provisional crown, and the screw-access hole was temporarily sealed with filling material. After concluding the restorative procedure, the donor area was sutured with simple stitches.

The postoperative instructions were as follows:

- Avoidance of any load on the treated region for three months;
- Topical application of 0.12% chlorhexidine gluconate (PerioGard®, Colgate-Palmolive) for 7 days, twice a day.

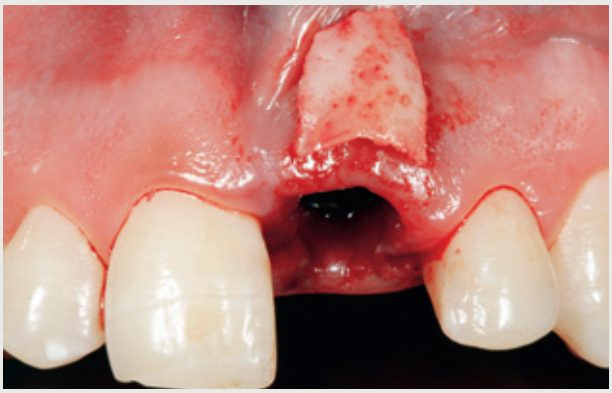
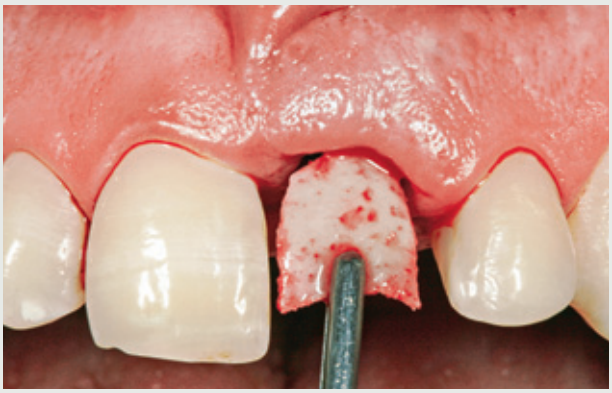
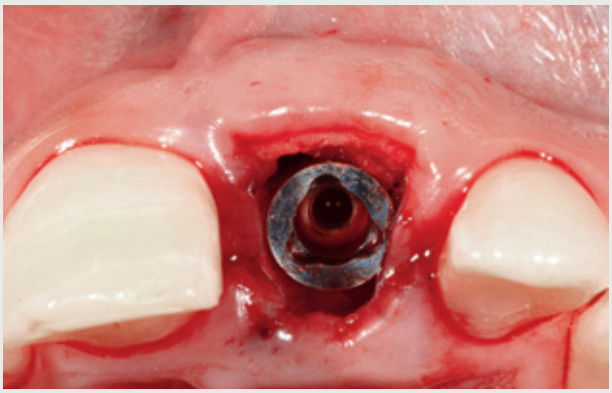


**Fig 10** Simulation of the final graft position.





**Figs 11 and 12** Placing the corticocancellous bone graft shaped to match the defect configuration.

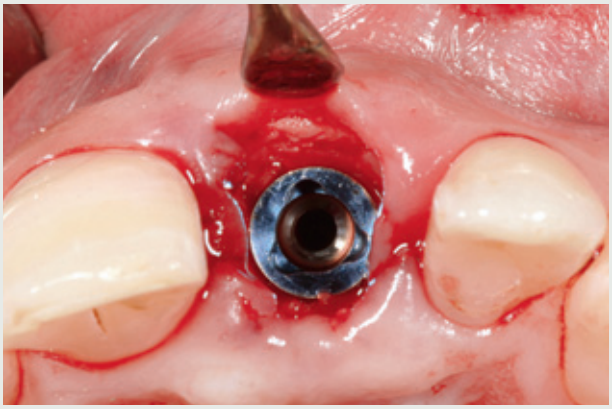
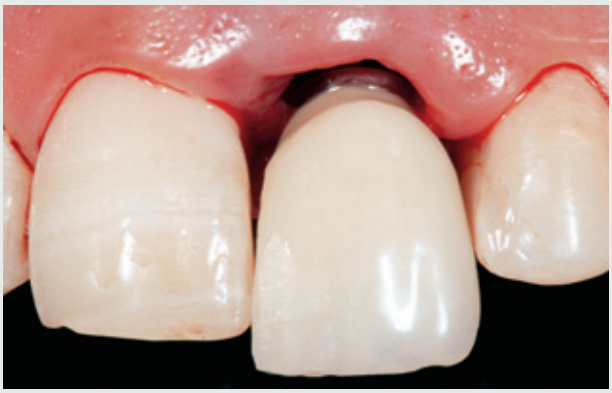


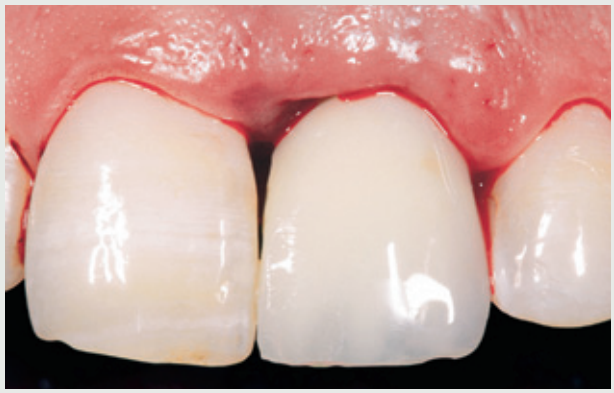
**Fig 13** After packing the particulate bone marrow between the medullar portion of the bone graft and the surface of the implant.

- Abstinence from smoking for at least 15 days.

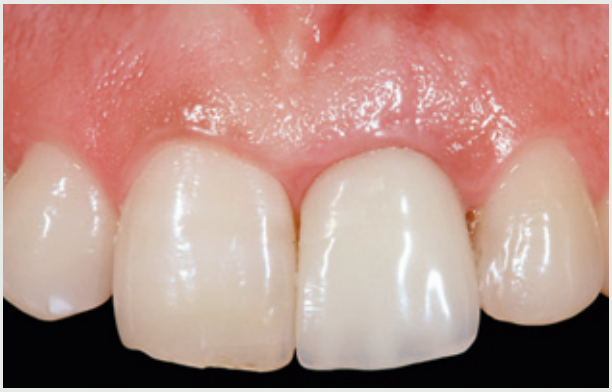
Clinical monitoring was undertaken every 2 days for the first 2 weeks and every 15 days for the next 4 months. After a period of 4 months, once the bone and gingival architecture had been reestablished (Figs 16 and 17), a careful impression was performed to capture the emergence profile (Fig 18).

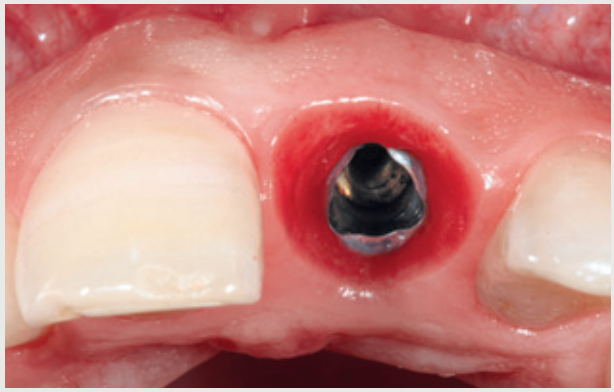
A Procera® titanium (Nobel Biocare) abutment was installed using a torque of 35 Ncm and a Procera® alumina cop-





**Figs 14 and 15** The provisional crown was installed providing marginal sealing.





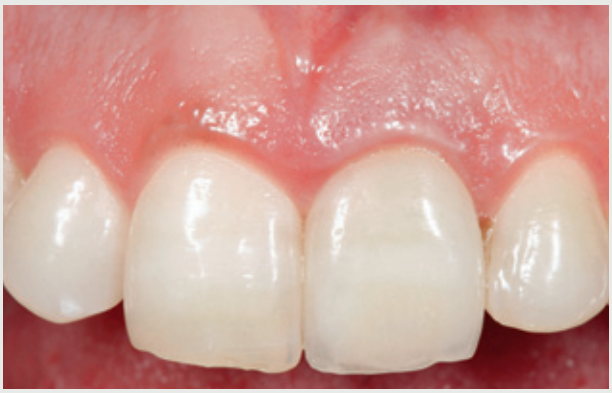
**Figs 16 and 17** Correct accommodation and maintenance of soft tissue volume observed 4 months later.

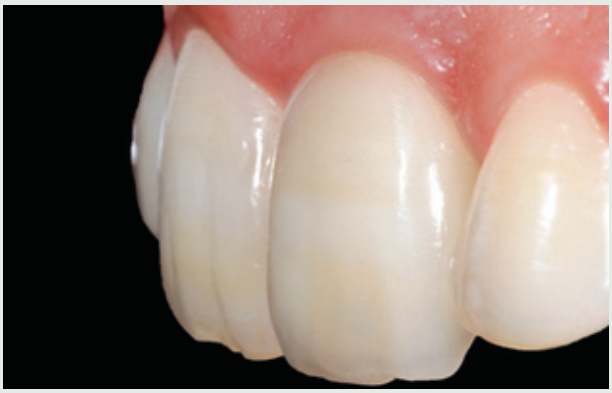
ing was constructed for porcelain application. After testing the porcelain and performing esthetic and functional adjustments, the crown was fixed with adhesive cement.

Clinical evaluation found evidence for good health and stability of the peri-implant tissues. There were no significant clinical alterations regarding the level of the gingival margin outline or papillae, comparing the treated area to the contralateral tooth (Figs 19 and 20).

Periapical radiographs were taken before, during and after the operation and again after 4, 12, and 36 months. CBCT images were acquired after the procedure and after 12 and 36 months (Fig 21). The computed tomography (CT) scans showed the reconstruction of the buccal bone wall. The preexisting alveolar defect was reconstructed and remained stable in height and thickness of the buccal bone wall, throughout the follow-up process.

**Fig 18** Plaster model reproducing the emergence profile.





**Figs 19 and 20** Clinical control after 36 months showing the stabilization of the soft tissue.

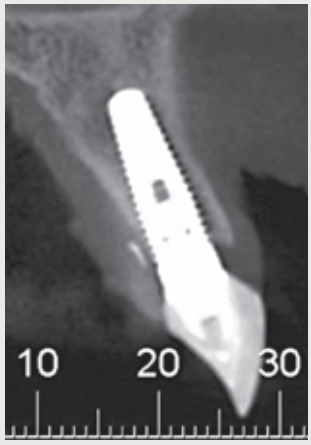



**Fig 21** Tomographic slice showing restoration of the buccal bone at 36 months after IDR.

## Discussion

Immediate restoration with dental implants after dental extraction is suggested to achieve esthetic restoration, maintenance of the bone, gingival architecture and reduction of patient discomfort.[1-4,14-20] However, an impediment to immediate restoration after dental extraction may be the morphology of the damaged socket, if there is greater involvement of the buccal cortical bone, due to thickness of the bone and reduced vascularization. Because the buccal wall is fragile, total loss of this cortical bone can often be seen, even without the involvement of the other walls.

The treatment alternatives for resolution of alveolar defects after tooth removal are widely documented in the literature,[7,9-11,13] and recommended as viable solutions before or after delayed implant placement. However, the esthetic results of these techniques are less predictable, when combined to additional risk factors, for example, a high lip line or thin gingival biotype. In addition, such techniques require long treatment time and present high morbidity.

As an alternative to block grafts and guided bone regeneration, the idea of the IDR technique is to promote a barrier with the corticancellous graft in the shape of the bone wall defect, stabilizing the particulate bone graft around the implant. This procedure represents significant gains in esthetic results and in total treatment time, since it enables the recovery of an alveolar bone defect in the same surgical implant installation and immediate provisionalization, without opening the flap and keeping the gingival architecture in the same position.

It is suggested that the maxillary tuberosity is an excellent donor area for alveolar reconstruction after dental extraction. In spite of providing a limited quantity of available bone for grafting in some cases, the use of the tuberosity has the advantages of excellent postoperative recovery and ease of graft adaptation in the receptor bed because of bone malleability. However, the harvesting of this graft may involve some risks, such as exposure of sinus membrane and damage of the last molar roots. In order to avoid these risks, besides the detailed preliminary assessment, careful technical execution and use of adequate instruments are necessary for the removal of this type of graft.

The vascularization pattern is known to be vital for bone grafting success. Because of the trabecular nature of grafts harvested from the tuberosity, these grafts have a high capacity for revascularization.[21-25] In addition, one study has indicated that the maxillary and mandibular periosteum and bone marrow from the maxillary tuberosity can effectively serve as reliable and easy-to-harvest intraoral sources of osteoprogenitor cells.[26] Graft cell survival is related to the efficiency of the surgical technique and the time taken to transfer the graft to the receptor area.[23] In fact, such grafts need to be manipulated quickly so that their vitality is not decreased.

It is known that early, low-intensity stimulation of a graft, without loss of mechanical stability, increases local blood flow and contact osteogenesis, thereby accelerating the process of bone graft incorporation.[24,27,28] Therefore, the immediate construction of the

provisional crown is fundamental in the described technique.

Otherwise, in undamaged sockets, the implant should be inserted by means of a palatal approach to achieve better bone anchoring, with three-dimensional positioning to spread the occlusal forces and enhance the esthetic results.[29]

The size of the peri-implant gap determines whether filling it with particulate bone is needed. Such a filling would preferably be autogenous, as this yields the best results with regard to bone healing.[14] When the diameter of the implant is smaller than the socket opening, the peri-implant gap must be filled with particulate bone, thereby minimizing contraction of the tissues involved.

Stabilization and close contact between the bone graft and the compromised site receiving the graft facilitate the revascularization process and favor early incorporation of the graft into the host vascular bed.[23-25,30,31] For this reason, particulate bone is required for filling the gap between the implant, the socket walls and the corticocancellous bone when the IDR technique is used. The main risk involved in performing this technique is not obtaining the correct adjustment and stabilization of the graft to the receptor site. This is more critical in cases of thin periodontal biotype. Therefore, special care must be taken in obtaining the correct adaptation of the corticocancellous graft and the condensation of particulate bone.

Upon reconstruction of the alveolar anatomy, and in accordance with the literature regarding the immediate restoration of implants,[32] the prosthetic crown used in this case was planned so that it would fit closely but without compression of the gingival margin, providing support and stability to the soft tissue. A concavity was sculpted subgingivally on the prosthetic crown emergence profile to prevent facial tissue compression and to assist in physiological remodeling of the soft tissue complex.

Using the technique described in this paper, buccal bone wall thickening due to palatal anchoring of the implant and grafting of corticocancellous bone was observed. Because of the greater thickness of the buccal bone crest, along with an adequate prosthetic crown emergence profile, a greater volume of soft tissue was obtained, thus providing better and more stable gingival margin outlines. Furthermore, the concavity of the definitive prosthetic crown emergence profile may influence soft tissue volume preservation. These results remained stable throughout the period of monitoring.

## Conclusion

In the reported clinical case, the stability of hard and soft tissue had been observed throughout the period of follow-up. This data indicate that the IDR technique may promote restoration of freshly damaged sockets, thus making immediate provisionalization of an implant possible, saving the patients from having several surgical interventions and avoiding the esthetic risks related to these procedures.

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