Proceedings of the 12th Closed Meeting of the European Academy of Esthetic Dentistry (EAED), Cracow, September 23–24, 2016

During the 12th Closed Meeting of the European Academy of Esthetic Dentistry (EAED), the Scientific Chairman, Prof Dr Markus Hürzeler, discussed topics with the group in such a way as to lead them to think "outside the box".

The Friday session was dedicated to a biological topic, and on the Saturday a prosthetic concept was critically analyzed.

Two members of the Academy (Dr Oliver Brendel and Dr Koray Feran) were asked to summarize the lecture and to describe the discussion and conclusions of the two days.

On reflection, the two days were extremely fruitful. The presentations initiated many interesting discussions, stimulating much thought "outside the box", as was intended. It was clear that it was not possible to draw concrete conclusions to immediately apply to our practices. But a clear take-home message for the clinician was not necessarily the intention of the meeting. In this distinguished group, the intention was more to expand the horizons of modern dentistry and stimulate thought about future trends, and the meeting certainly succeeded in this aim. As scientific chairman, I was fully satisfied and would like to thank all the participants who contributed to the success of this meeting.

The Friday started with the following topic:

Innovations for alveolar ridge preservation – clinical strategies outside the box

Prof Dr Ronald Jung

Moderator: Prof Dr Ronald Jung
"Gladiators": Dr Stefan Neumeyer (Germany); Dr José Carlos Martins da Rosa (Brazil)

The meeting was opened by moderator Prof Dr Ronald Jung, who asked how often we extract teeth in practice. The figures presented (Switzerland: 400,000 per year, and the USA: 50 million per year) indicated that a scientific strategy for how best to conserve tissue following extraction was a globally relevant question. When examples from the available literature were presented, it became apparent that extensive bone volume loss (50%) was evident in patients where no attempt was made to conserve alveolar volume following extraction. However, this loss of bone volume could be reduced to 10% to 17% if alveolar augmentation was carried out at the time of extraction. Prof Dr Jung then presented the co-presenters for the morning session, who went on to discuss their respective techniques on how this might be achieved.

The Tissue Master Concept (TMC): innovations for alveolar ridge preservation

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Extraction of a tooth leads to resorptive processes, which may be associated with considerable loss of alveolar tissue.[1] The resulting deficits can make subsequent implantation and prosthetic restoration more difficult. Various augmentation techniques to avoid or diminish this problem have now become established. All these techniques are invasive, most involve bone substitutes, and, especially in the case of larger defects, all require significant surgical skill. It has been known for a long time that an extracted tooth has a remarkable bioregenerative potential if replanted.[2] This fact is utilized in the technique presented here. Root segments of the previously extracted tooth are replanted and extruded after a short healing period.[3]

Clinical procedure

Prior to extraction, supragingival plaque and calculus have to be removed. The subsequent extraction is performed as gently as possible, and without mechanical division of the gingival adhesion. Following extraction, the apical region can be revised through the socket because of inflammatory processes, but this does not affect the later result. The extracted tooth should be placed in sterile physiological saline until use. The tooth will be resected about 2 mm below the supra-alveolar fibrous apparatus or below an intact circular periodontal ligament to produce a biologically active replantation about 2 to 3 mm in height. After resection, the root canal has to be prepared and sealed with an adhesive cement (RelyX Unicem, 3M ESPE; or Clearfil SA, Kuraray). The root segment will then be replanted in the original position and covered with a protective splint (Fig 1). In the case of a multiroot maxillary molar with extensive periodontal denudations, all segments for replantation can be obtained from the palatal root of this tooth, for example (Fig 2). After a healing or fixation period of roughly 10 days, the replanted root can be extruded about 2 mm over a 2- to 5-day period in anticipation of a vertical loss of alveolar volume. Extrusion is obtained with elastic rubber rings and a set of extrusion and bar units (TMC Extrusion, Komet) (Fig 3). Subsequent fixation for 8 to 10 weeks has to be obtained using a composite splint.

Nearly all stages of treatment can be performed with conventional instruments. The teeth can be dislocated with Bein elevators and extracted with anatomically shaped forceps. The subsequent resection can be performed horizontally with a diamond separating disk or in a scalloped manner with a Lindemann drill, cooling with sterile saline.

Results

Clinical observations, as well as deep venous thrombosis (DVT) evaluations and three-dimensional (3D) model analyses, showed that the alveolar structures can be preserved almost completely by replantation, especially the buccal lamella, which is usually resorbed. Extrusion of the segments induces vertical tissue apposition.

Replanted root segments heal within 10 days without complications. A longer healing period of 30 days must be observed when root segments are ob-

Fig 1 Formation and replantation of a root segment: **(a)** extracted tooth 24; **(b)** forming the root segment with a surgical milling cutter; **(c)** preparing the root channel; **(d)** filling the root with RelyX Unicem cement; **(e)** replanting the segment; **(f)** covering the segment with a protective film.

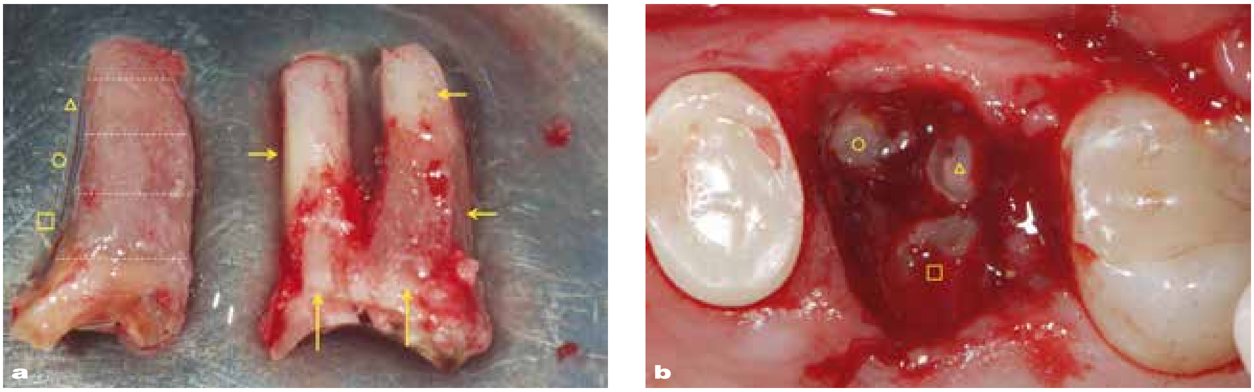


Fig 2 Extracted maxillary molar: **(a)** periodontal denudations on the buccal roots, but segments can be obtained from the palatal root; **(b)** replanted segments – the apical smaller ones to the buccal side, and the form congruent cervical segment to the palatal side.

tained from a different root of the same tooth, so that it does not match the alveolar volume exactly (Fig 2).

The 3D model analyses show that the alveolar soft and hard tissue structures will largely be preserved by the replanted root segments. Palatal and lingual tissue loss is very low in the vertical and horizontal dimensions. Tissue loss in the region of the labial and buccal bone lamella is in the same range, and is very low (Fig 4).

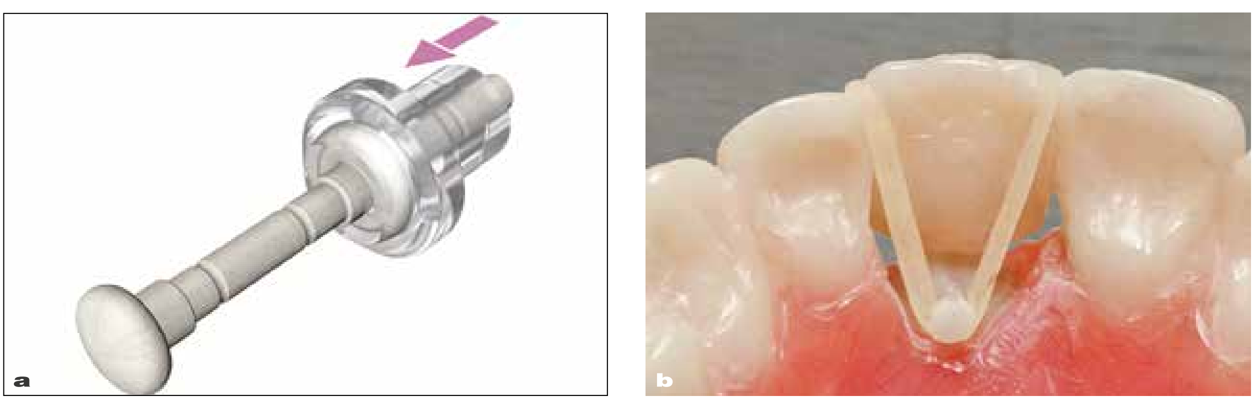


Fig 3 TMC Extrusion set: **(a)** pivot unit; **(b)** mechanism of action.

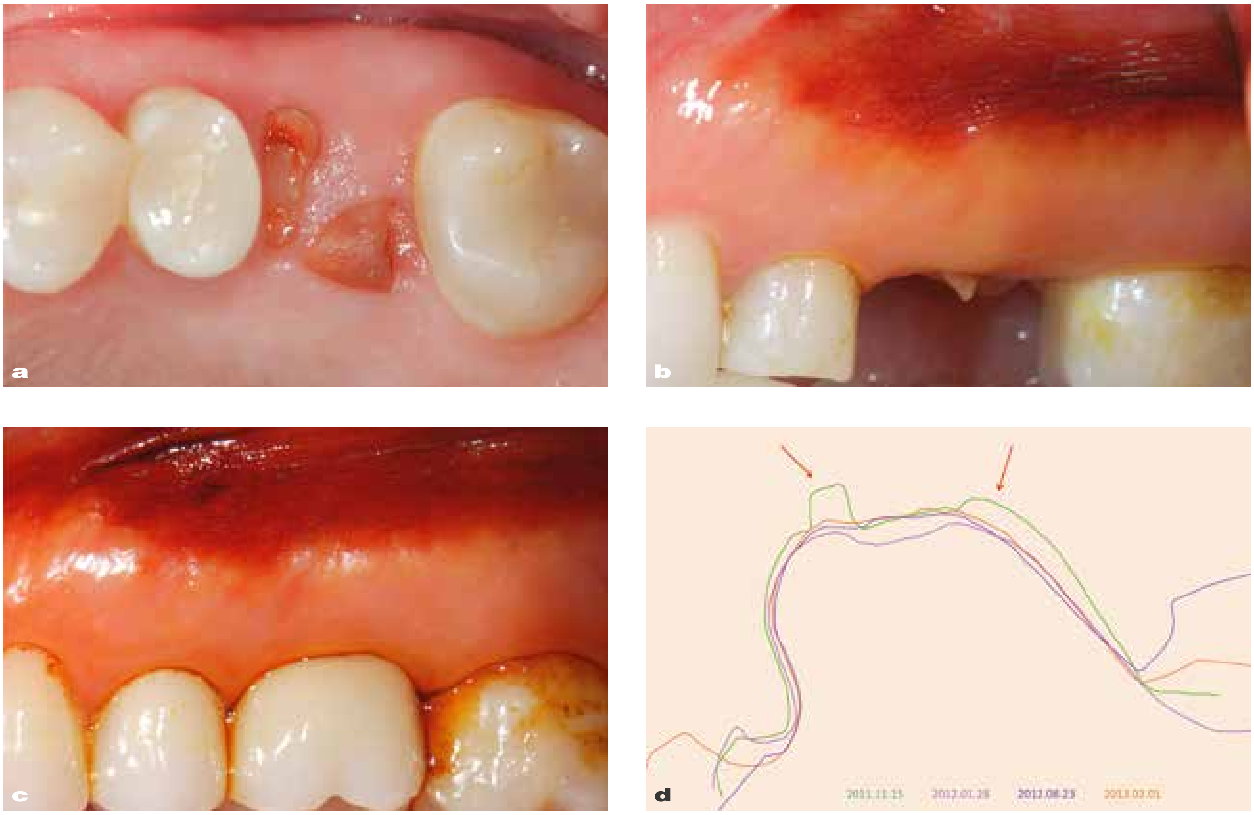


Fig 4 Preservation of the alveolar tissue and volume: **(a)** replanted root segments with preservation of the buccal lamella; **(b and c)** preservation of the attached gingiva after replantation and after implant-based crown in region 15/16; **(d)** 3D profiles of scanned models showing the cross-section of the alveolar volume over a period of 15 months; **(e)** vital healthy bone without any substitute.

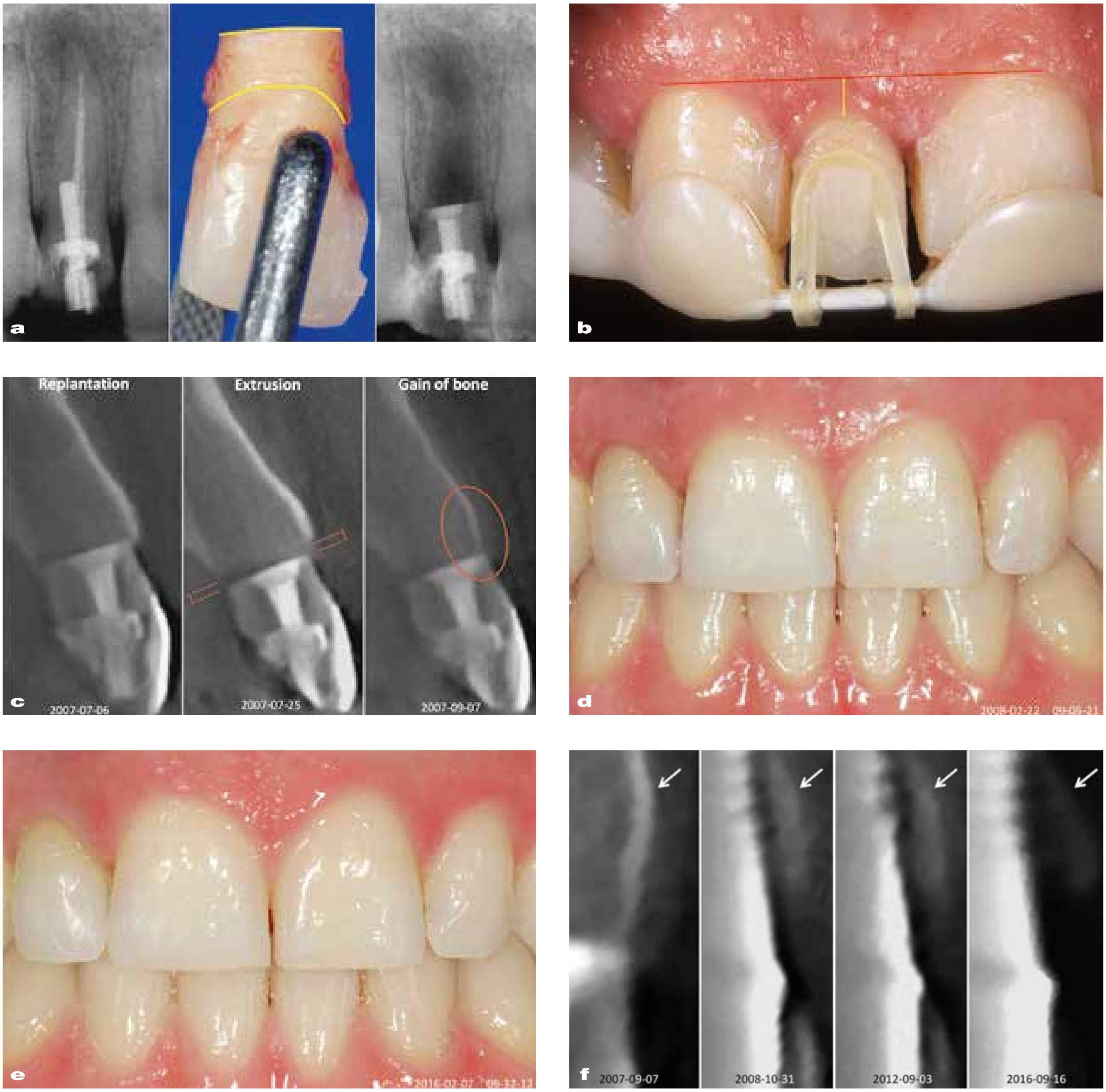


Fig 5 Extrusion of an orthograde replanted root segment: **(a)** replantation; **(b)** extrusion; **(c)** “follow-up” of the buccal lamella; **(d)** implant-based crown 12; **(e)** result 8 years later; **(f)** preservation of the buccal bone lamella.

As the photographs show, the extrusion of replanted root segments leads to a coronal movement of the gingival margin and the widening of the attached gingiva (Figs 5 and 6). The change accounted for roughly 80% of the extrusion movement. The histological specimen shows a vital and healthy bone, characteristic for the alveolar region (Fig 4).

In all cases, extrusion of replanted root segments led to vertical movement of the adjacent alveolar tissue structures. The vertical bone gain can be identified over the entire socket and the labial and buccal bone lamella. The vertical changes are less marked in the palatal and lingual bone margins. The vertical "follow-up" corresponded to the figures in the literature of about 80% to 90% of extrusion movement. The radiographs and DVT images show that the sockets are entirely filled with bone after a period of 8 to 10 weeks (Figs 5 and 6).

Discussion

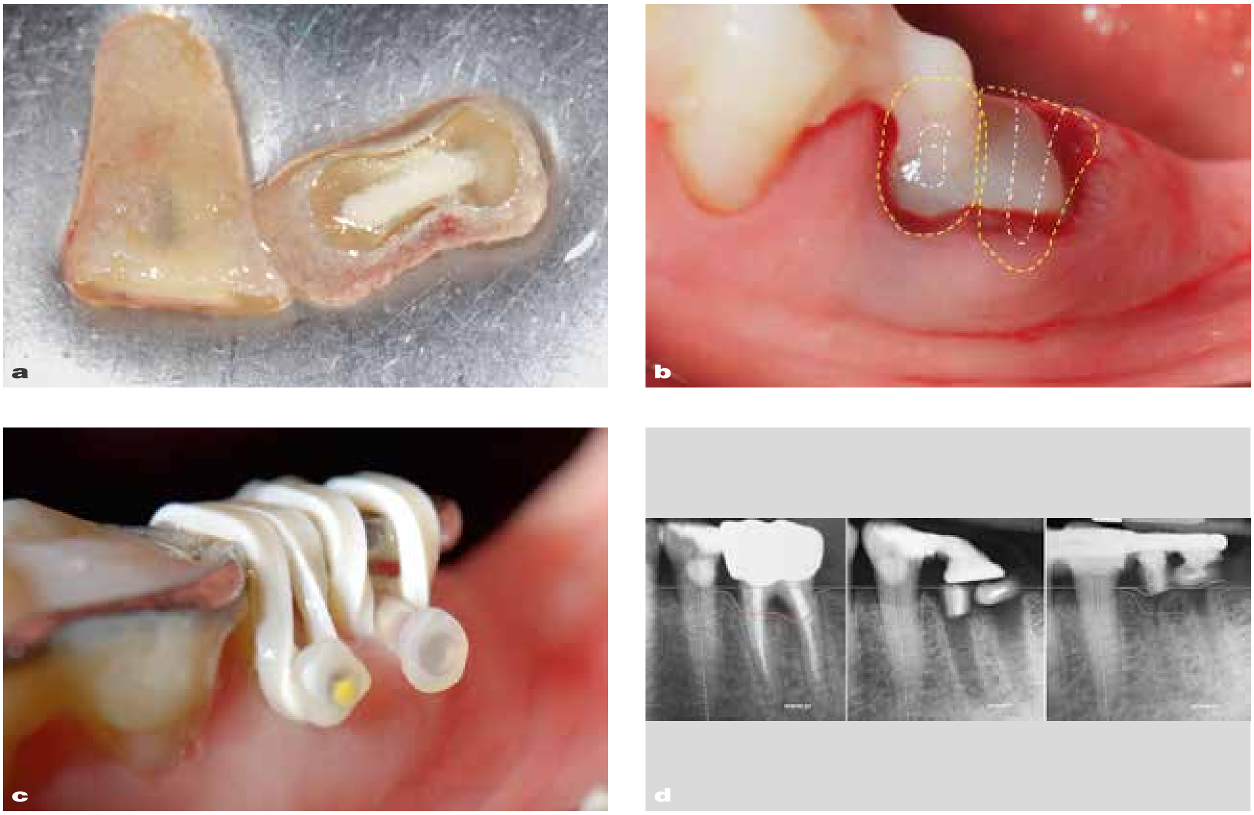
The structural quality, quantity, and stability of peri-implant tissue are of fundamental importance for a long-term stable and esthetically attractive outcome. It is therefore very important to insert implants in a stable bone bed and to prepare the implant site as well as possible.

This new biological approach sees the periodontal ligament and the supracrestal fiber structure as the keys to preserving, developing, and regenerating alveolar structures.[4-6] The presence of a tooth or a segment of a tooth may influence the preservation or regeneration of alveolar structures. It has repeatedly been shown that extrusion of a tooth causes coronal movement of all oral hard and soft tissue structures bordering the tooth.[7,8] This fact is used, for instance, when correcting the gingival contour line to achieve an attractive appearance in esthetic treatments.[9] Even in the case of teeth with advanced periodontal disease, regeneration of lost alveolar structures is possible by means of extrusion.[10] Based on this structural and functional association, various authors have employed extrusion of a tooth to prepare an implant site.[11,12] The positive influence on both alveolar tissue structures should be emphasized.[13-15] A disadvantage is the waiting period before an implant can be placed.

In this biological concept, the use of root segments is completely new. The results show clearly that the potential for preservation and regeneration of replanted and extruded root segments is similar to that of whole teeth.

Another advantage of the new technique is the possibility of opening and revising apical processes directly through the open socket, that is, minimally invasively and without gingival incisions. This is important, especially in difficult esthetic situations, for example, a high smile line.

The results show clearly that ossification of the socket is complete after just 8 to10 weeks. The waiting period for implantation after orthodontic therapy, proposed by Zachrisson, can therefore be markedly reduced, leading to a much shorter treatment period.[16] The implantation of one-piece Aesthura Immediate implants in the regions treated with the new method did not show any differences compared with the classic procedure of delayed implantation after



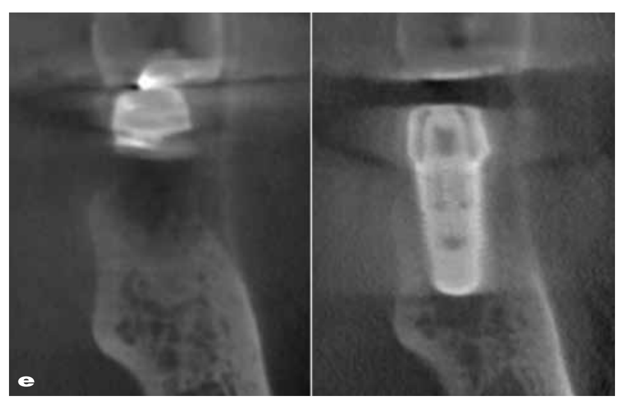


Fig 6 Extrusion of an orthograde and horizontal replanted root segment: **(a)** root segments; **(b)** replanted root segments; **(c)** extrusion of the root segments; **(d)** "follow-up" of the alveolar bone; **(e)** DVT examination showing a fully filled up alveolar volume.

11 years.[2] The low level of variation in the achieved tissue preservation was striking, suggesting that the result of treatment is reproducible and predictable. This treatment method may allow for the manipulation and optimization of the gingival contour line for esthetic reasons during implant-based prosthetic rehabilitation.

The presented method facilitates preservation and regeneration of all osseous alveolar structures after an extraction. The subsequent implant site provides a sufficient basis for prosthetic treatment within a curtailed treatment period, which is stable in the long term and esthetically sophisticated. Further studies are necessary to investigate the full potential of this new method.

Conclusions

1. Replantation and extrusion of root segments facilitates preservation and vertical regeneration of functionally important alveolar hard and soft tissue. Natural wound healing potential and extrusion-induced tissue regeneration are evidently utilized.
2. The results are predictable and demonstrate a very small volume deficit.
3. The results meet both functional and high esthetic demands, and at the minimum are equivalent to augmentation techniques.
4. The procedure is simple, saves time and money, and is minimally invasive.
5. Further studies are necessary to establish the full potential of this new method.

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Summary of The Tissue Master Concept (TMC)

Koray Feran

This novel biological approach sees the coronal aspect of the periodontal ligament and the supracrestal fiber structure as the keys to preserving, developing, and regenerating alveolar structures, and not necessarily the apical part of the root, as was previously believed. The results show clearly that the potential preservation and regeneration of a replanted and extruded root segment is similar to that obtained from a whole tooth. Dr Neumeyer also indicated that similar results could be achieved in cases where part of the buccal plate was also missing.

Question-and-answer session and discussion

During the question-and-answer session, Dr Neumeyer was asked whether adhesion of the soft tissues to the entire periphery of the root fragment was predictable, and whether he had any experience with development of a periodontal pocket or lack of soft tissue adhesion to this section. Dr Neumeyer responded by saying that the soft tissue adhesion was very predictable, providing the root fragment was properly extracted, treated, replanted, and protected without movement during healing. Surface contamination or root surface damage during extraction and processing or movement during healing could lead to incomplete tissue adhesion or loss of the fragment, which could potentially lead to asymmetrical or incomplete regeneration, and thus suboptimal results.

However, if the technique has been perfected, and providing all the parameters are followed, tissue adhesion to the fragment in a relatively short period is routine, and allows for the application of coronal traction to the fragment to facilitate quite rapid stretching of the soft tissue compartment. This, in turn, leads to additional bone height formation during the period of normal socket healing.

Dr Neumeyer was questioned on some of his cases as to whether the bone infill was due purely to the natural healing of the socket, or whether TMC provided any additional benefit, as radiographs of cases were non-standardized and therefore scientifically not directly comparable.

While admitting that it is not possible to standardize radiographs easily, the fact that volume in three dimensions was maintained and indeed gained in the supracrestal direction was clearly shown by his extensive case series, both clinically and radiographically, though this was obviously also at a time of natural socket healing.

Dr Neumeyer indicated that this presentation was a proof of concept with a large series of clinical cases and not a scientific study to measure actual volume regenerated. He admitted to the requirement for further studies to quantify the volume gain using TMC.

While there is a waiting period before the implant can be placed, it is not significantly different from the delayed approach of placing implants after initial socket healing, and with considerably superior maintenance and indeed augmentation of hard and soft tissue volume, as well as with a more conservative, less costly, and minimally invasive flapless approach.

Dr Neumeyer compared the relatively reduced trauma of maintaining and building further volume utilizing TMC, which is carried out using flapless extraction and maximizing the body's own regenerative potential rather than committing a patient to an implant placement with additional biomaterials and bone augmentation surgery that would necessitate larger flaps and the risk of hard and soft tissue complications. He implied that the biological and financial cost was far lower than conventional delayed placement.

The application of rapid prototyping to improve bone reconstruction in immediate dentoalveolar restoration: a case report

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Abstract

Purpose: This article describes the use of rapid prototyping (RP) for diagnosis, planning, and execution of the reconstruction of hard and soft tissue in socket defects using immediate dentoalveolar restoration (IDR).

Summary: In cases of tissue loss in anterior dental areas, esthetic rehabilitation poses a major challenge with respect to treatment planning with the goal of long-term tissue maintenance. The IDR technique consists of immediate reconstruction in a single procedure of bone and soft tissue around implants placed immediately after extraction, and prosthetic rehabilitation. As this procedure is immediate and flapless, the correct diagnosis of tissue loss and correct graft adaptation are mandatory. RP can increase the precision of the procedure, as demonstrated using a clinical case characterized by total loss of the buccal bone wall and gingival recession. The results were evaluated by clinical assessment, photography, radiography, cone beam computed tomography (CBCT), and prototyping.

Conclusion: The application of RP facilitated the execution of IDR as it enabled more accurate diagnosis of the socket defect and more precise adaptation of the tissue graft. A clinical study should be conducted to evaluate the effects of RP on the clinical results of the IDR technique.

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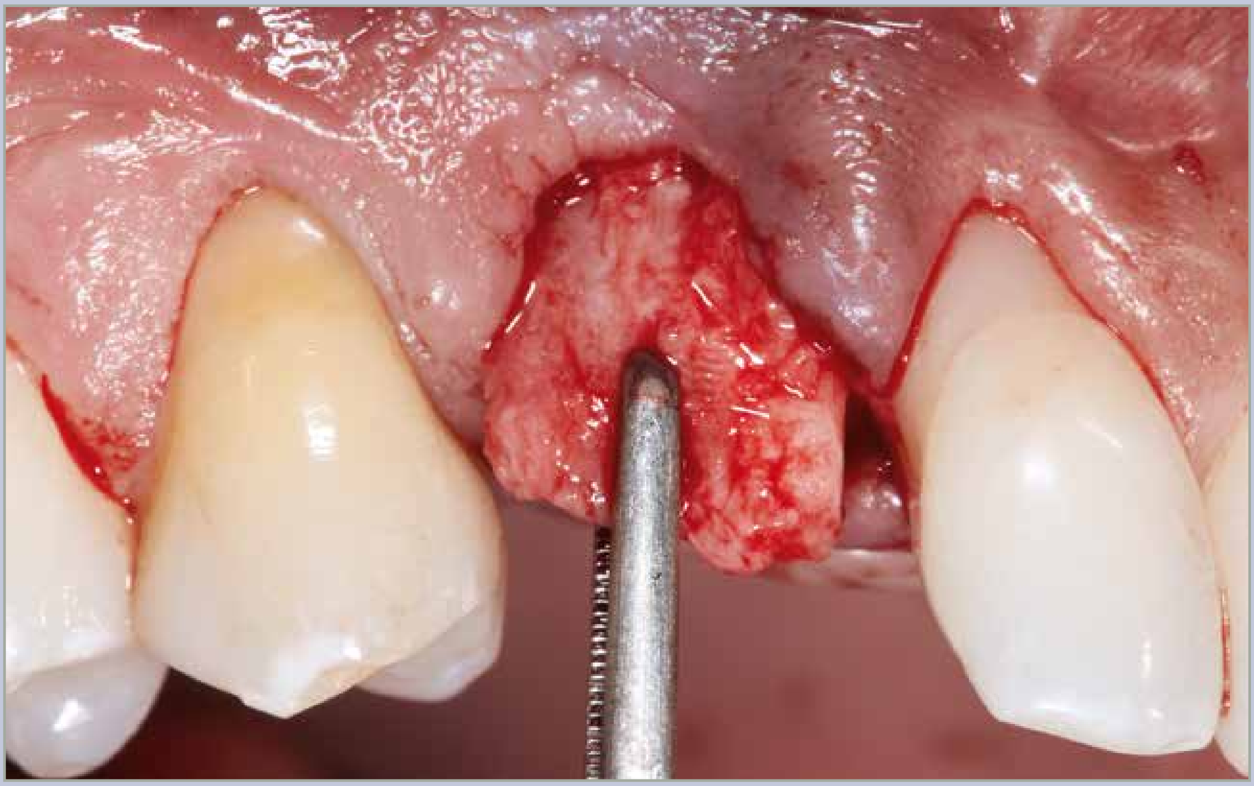

Introduction

Immediate implant placement after the extraction of a condemned tooth is challenging due to the presence of bone defects, infection, and/or inflammation. The preservation or creation of harmonious soft tissue contours in the peri-implant mucosa, as well as the level of bone support, are key factors affecting the achievement of favorable esthetic results after implant treatment in the esthetic zone.[1,2]

Results of many clinical studies support the use of autogenous bone block grafting and/or guided bone regeneration for the reconstruction of bone defects in compromised alveolar sockets during and after tooth removal.[3-6] These cases can also be treated successfully using immediate dentoalveolar restoration (IDR), a one-stage technique that enables the performance of dental extraction, implantation, and provisionalization during the same procedure as flapless bone reconstruction using a corticocancellous graft or triple graft harvested from the maxillary tuberosity.[1,7,8] The IDR technique reduces overall cost and treatment time, and has been shown clinically and tomographically to effectively achieve soft tissue and bone stability.[9]

According to the IDR protocol for total loss of the buccal bone wall, a corticocancellous or triple graft is shaped to the defect size and inserted between the implant and the remaining buccal soft tissue, without opening a flap.[1,7,8] Then, particulate bone is compacted until it completely fills the gaps between the main graft and the implant surface.[7,8] The provisional restoration is made at the same time. The creation of a proper anatomical contour of the prosthetic emergence profile is mandatory to guide soft tissue healing.[9-11]

Implant position is a primary factor in the achievement of hard and soft tissue stability in IDR, as in any other technique. In the protocol used to select the diameter and position of an implant placed in the esthetic zone, the buccopalatal distance from the socket opening serves as a reference.[11] Regardless of which tooth is replaced, a gap of approximately 3 mm between the buccal implant surface and the outer buccal bone wall is expected. After gap filling, peri-implant tissue remains stable. This surgical protocol has yielded satisfactory and predictable esthetic outcomes in a prospective case series.[12]

The advantages of IDR include easy harvesting of the graft from the tuberosity, adequate adaptation to the recipient region due to the malleability of the bone fragment, and effective bone and gingival healing due to the graft's function as a biological membrane.[9] Furthermore, the trabecular nature of grafts harvested from the maxillary tuberosity contributes to increased revascularization capacity and the release of growth factors to the recipient site.[7,8] Immediate placement of the provisional restoration accelerates tissue healing, forming the ideal gingival prosthetic emergence profile.[7-9]

The most challenging aspects of the technical application of IDR are related to the correct diagnosis of socket defects and the adaptation of the graft in the recipient site, as the procedure is flapless. In this context, the addition of a tool that facilitates the stages of the procedure would increase precision.

Rapid prototyping for IDR

The term "rapid prototyping" (RP) designates a set of technologies that enable the computer-aided manufacture (CAM) of physical models based on design data. This technology, also known as computer-aided design/computer-aided manufacturing (CAD/CAM), has revolutionized many disciplines in the fields of engineering and science.[13] It typically involves the use of three-dimensional (3D) printers that allow designers to quickly generate defined prototypes of their designs.

In medicine, the basic principle of RP involves the construction of a 3D structure based on digital computerized tomography (CT) data. RP is a new approach to surgical planning and simulation before surgical intervention. Prototype models are becoming important tools for diagnosis and surgical planning. Although virtual 3D imaging provides clear information, discrepancies persist between onscreen visualization of the model and the manipulation of real anatomic structures during surgery.[14]

Stereolithography is commonly considered to be the first RP technique. Since its development in 1986, several different RP techniques have become available.[15] Besides stereolithography, existing RP technologies include fused deposition modeling, subtractive milling, and 3D printing. These technologies adhere to the basic RP principle, with differences in materials and production methods.

The PolyJet printing technology system builds models by the addition of photopolymer resin layers. A CAD 3D standard template library (STL) file is sectioned virtually into 16-mm-thick layers using the system's software. A printhead, composed of hundreds of microjetting heads, injects a layer of resin on the build tray only in areas corresponding to the previously prepared cross-sectional profile, leaving the other areas free of resin. Simultaneously, the resin is cured with ultraviolet light. The repeated addition and solidification of resin layers produces a solid 3D acrylic model.[16]

The first report of the use of prototyping in dentistry dates back to 1990.[17] The first reports of the use of a stereolithographic model in bone grafting and the use of RP were published in 1994[18] and 1995,[19] respectively. The use of RP in bone grafting has been associated with reduced operating time, less-invasive procedures, and more predictable and better-adapted grafts.[20-22]

The prototyping technique is based on a series of simple steps. Cone beam computerized tomography (CBCT) is first performed to generate a Digital Imaging and Communications in Medicine (DICOM) file, which is uploaded into CAD software for determination of the most suitable threshold for 3D reconstruction. The area of interest is then selected, and the CAD project is saved as an STL file. This file is sent to the 3D printer; it provides specific coordinates for polymer printing of the layers that make up the 3D physical object. This was the RP technique applied in the execution of IDR in the following clinical case.

Fig 1 The maxillary right canine showed buccal wall loss, gingival recession, and abscess.

Fig 2 The buccal probing depth was approximately 7 mm, and the periodontal biotype was very thin.

Fig 3 CBCT with soft tissue enhancement showed total loss of the buccal bone wall and a small amount of bone remaining beyond the root apex.

Case report

A 28-year-old man with a periodontally compromised maxillary right canine presented with abscess and fistula, severe bone loss, and gingival recession (Fig 1). The right lateral incisor also presented with gingival recession. The periodontal biotype was thin. Intraoral examination with dental probing revealed buccal wall loss. The buccal probing depth was approximately 7 mm (Fig 2).

CBCT with soft tissue enhancement confirmed the total loss of the buccal wall beyond the root apex (Fig 3). A 3D image obtained with this modality showed the bone defect clearly (Fig 4). An RP image was obtained, which enabled measurement of the extension of the buccal aspect of the bone defect in the coronoapical and mesiodistal directions (Fig 5).

Considering the patient's esthetic and functional demands, the planned treatment was IDR, following the protocol described elsewhere.[1,7,8] The patient was prescribed antibiotics for 5 days before and 7 days after surgery due to contamination of the affected area. The treatment procedure included the minimally invasive extraction of the maxillary right canine (Fig 6); curettage and cleaning of the socket (Fig 7); immediate implant placement in the correct 3D position (Fig 8) to achieve primary stability, leaving a gap of about 3 mm on the buccal aspect (Fig 9); construction of a screwed provisional crown with an ideal emergence profile (Fig 10); and reconstruction of the socket bone defects using a triple graft harvested from the maxillary tuberosity (Figs 11 and 12), to restore the buccal defect and compensate for the soft tissue damage.

To facilitate adaptation of the triple graft in the recipient site, allowing for better reconstruction and accelerating graft incorporation, the graft was shaped to the defect over the prototype (Fig 13). It was then inserted between the soft tissue and the implant (Fig 14), maintaining a biological distance of about 2 mm apically from the bone graft to the gingival margin, and ensuring placement of the soft tissue graft 1 mm above the gingival margin. The residual gaps were filled with particulate cancellous bone harvested from the same donor area, while maintaining the reconstructed bone wall and surrounding soft tissue (Fig 15). The screwed provisional crown was placed immediately and adjusted so that it was out of occlusion (Fig 16).

Four months later, the soft tissue showed volume maintenance, with appropriate positioning of the papillae (Fig 17). CBCT showed complete restoration of the buccal bone (Fig 18). The definitive restoration was accomplished after 5 months postoperatively, with no soft tissue compression (Figs 19 and 20).

Clinical evaluation after 2 years showed stability of the soft tissue volume with regard to the gingival margin and papillae (Fig 21), and CBCT showed buccal wall stability (Fig 22). A new prototyping was obtained from the CBCT performed 2 years postoperatively, showing the completely restored buccal wall with relevant thickness (Fig 23).

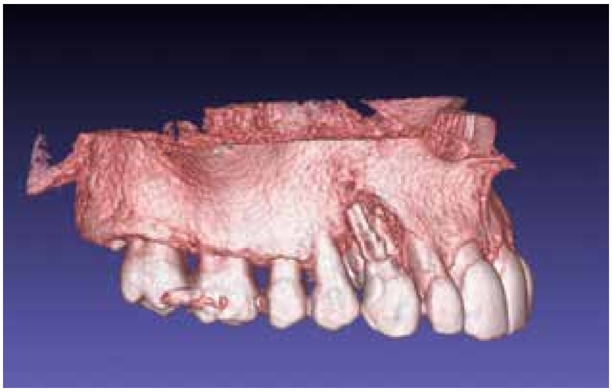

Fig 4 A 3D image showed the buccal bone defect.

Fig 5 The defect was evaluated through the RP model. The extension of the buccal aspect of the bone defect in the coronoapical and mesiodistal directions was measured.

Fig 6 The damaged tooth was extracted using a minimally invasive procedure that favored preservation of the remaining bone walls. The soft tissue collapsed due to the absence of the buccal bone wall.

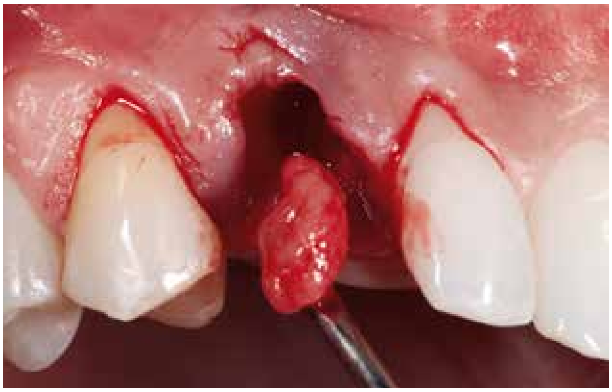

Fig 7 Careful curettage of the socket was performed to completely remove the granulation tissue and remaining periodontal tissue.

Fig 8 The implant was anchored in the remaining apical bone and at the palatal wall. Primary stability (40 Ncm) was obtained.

Fig 9 The 3D positioning of the implant allowed a 3-mm gap on the buccal aspect.

Fig 10 A screwed provisional restoration was manufactured with an adequate emergence profile to allow space for the correct accommodation of the tissues.

Fig 11 The triple graft and corticocancellous graft harvested from the maxillary tuberosity.

Fig 12 Triple graft: connective, cortical, and marrow layers in a single piece.

Fig 13 Reshaping of the triple graft over the prototype according to defect configuration.

Fig 14 Triple graft insertion.

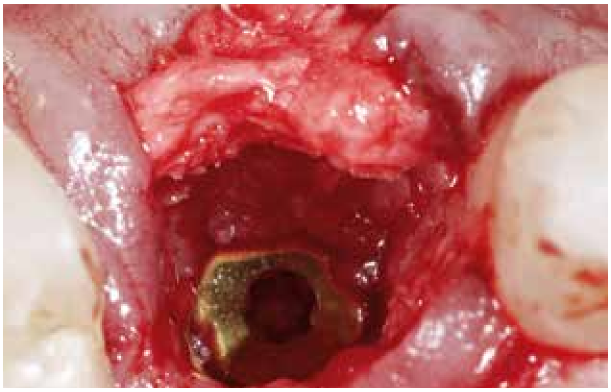

Fig 15 Particulate bone was compacted to completely fill the gaps between the marrow portion of the triple graft and the implant.

Fig 16 The screwed provisional crown was inserted; its emergence profile allowed correct accommodation of the triple graft.

Fig 17 Four months postoperatively, the soft tissue had healed and maintained an appropriate position.

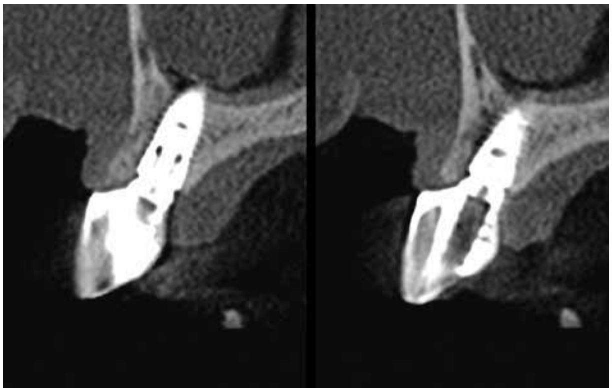

Fig 18 A CBCT image of the soft tissue obtained 4 months postoperatively. The buccal wall is completely incorporated, with relevant thickness.

Fig 19 The screwed definitive restoration with an ideal emergence profile. The cervical anatomical contour of the crown accommodated the soft tissue volume on the buccal and proximal aspects.

Fig 20 Insertion of the porcelain crown with no soft tissue compression.

Fig 21 Clinical follow-up at 2 years postoperatively showed stability of the soft tissue.

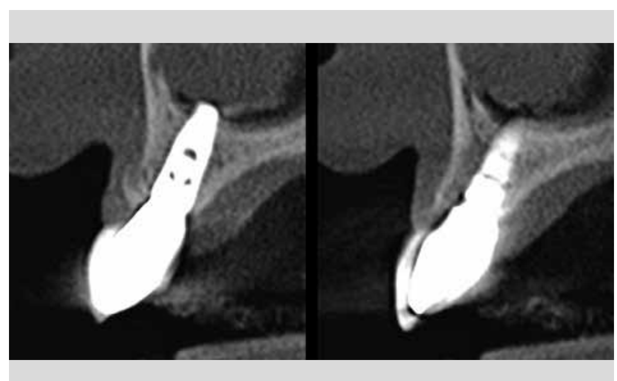

Fig 22 CBCT performed 2 years postoperatively highlighted the buccal wall stability in terms of thickness and height.

Fig 23 **(a and b)** The 3D image and prototype obtained 2 years after the procedure showed the maintenance of the bone architecture.

Discussion

Several surgical alternatives for bone augmentation in postextraction compromised sockets have been described.[3-6] However, some of these techniques require long rehabilitation periods and are costly. The IDR technique using a maxillary tuberosity graft represents the achievement of significant gains in esthetic results and treatment time; it enables reconstruction of the socket bone defect during the same surgery as implant installation and immediate provisionalization, without opening a flap and while maintaining the position of the gingival architecture.[8] As described previously, the blood supply is maintained when the soft tissue and periosteum remain attached to the buccal bone, and the bone supply will be maintained, enabling rapid graft revascularization.[23,24]

Cortical bone is less dense on the buccal, palatal, and basal aspects of the maxillary tuberosity than on other maxillary and mandibular bones.[25] Due to the thinness of the cortical bone, maxillary tuberosity grafts are easily shaped while maintaining the cortical structure, which acts as a biological barrier, stabilizing the soft tissue and the particulate bone graft around the implant.[8] Due to its total porosity and porous volume, the corticocancellous structure can act as a scaffold for cellular and vascular growth.[26] The maxillary tuberosity is a source of osteoprogenitor cells and growth factors.[27] Taken together, the cortical and cancellous bone from the maxillary tuberosity can be considered to form an ideal structure for bone regeneration, as they provide a natural scaffold filled with osteoblastic cells and growth factors.[7,8]

The long-term success of IDR can be attributed in part to the structural and biological characteristics of the tuberosity graft and its proper manipulation and adaptation to the recipient site.[9]

In the case presented in this article, IDR was used in combination with RP. The use of RP in bone grafting surgery has enabled the performance of less-invasive procedures, diagnosis, and planning and execution of hard and soft tissue reconstruction. The skeletal reproduction produced by RP serves as the base model for bone reconstruction, aiding the shaping of a graft to the ideal dimensions, and the positioning of the graft in the recipient site.[28-32]

The use of prototyping has facilitated important aspects of IDR, especially the diagnosis of alveolar defects without opening a flap, and the dimensional planning of graft harvesting from the donor area. In addition, it has facilitated graft adaptation to the recipient site, making this step more rapid, as the graft can be previously adapted to the model.

Conclusion

The case reported here illustrates the clinical outcomes that can be achieved with IDR, including proper implant rehabilitation in a fresh compromised extraction socket with alveolar bone and soft tissue defects. When properly indicated and performed, this technique has a high rate of success. The addition of RP in this clinical case enabled easier diagnosis of socket defects and faster surgical management, as well as more accurate graft adaptation in the recipient site during IDR.

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Summary of the application of the immediate dentoalveolar restoration to improve bone reconstruction in compromised sockets

Koray Feran

Question-and-answer session and discussion

During the question-and-answer session, Dr da Rosa indicated that he prefers to administer 5 days of preoperative antibiotics prior to this technique when in the presence of infection or abscess. He reiterated the fact that the only graft stabilization was provided by the stability of the dental implant, the immediate crown placed on it, the compaction of the bone graft into the space between the labial soft tissue and the implant, without over-distending soft tissue that may lead to breakdown or loss of vascularity.

The immediate questions posed to Dr da Rosa were whether he thought that doing everything in one procedure was a relatively high-risk approach, considering the necessity of a donor site that can be anatomically quite variable, and which would not always yield the ideal combination of cortical and cancellous bone and soft tissue volume.

Dr da Rosa indicated that he reviewed the patient every 2 days and photographed the progress of healing to ensure that any complications were detected early. He reported that this was a very successful technique overall, and that complications were rare in his experience, although he also admitted that any loss of stability of the implant or the graft would likely result in a complex failure that may require further stages to reconstruct.

Dr da Rosa admitted that this was a technique-sensitive and advanced procedure that should be undertaken only by experienced clinicians strictly following the protocol. He mentioned the advantage of harnessing the maximum healing potential of the site utilizing a flapless process, and therefore reducing soft tissue scarring and potential complications of open flap surgery in the recipient site in the esthetic zone. He maintained that the support to the soft tissue provided by vascular harvested bone was better than the use of a dry biomaterial, and that while the tissue protected the bone, the well-vascularized donated bone also provided an ideal healing environment for the soft tissue, without the use of membranes or biomaterials.

Dr da Rosa's preference is to have a donor site where significant amounts of vital bone can be harvested, and to reduce the morbidity at the recipient site, which he considers more important.

In cases where one felt that there was inadequate bone or tissue volume in the donor site, a CT scan of the donor site would also be required, but Dr da Rosa remarked that it is mandatory to have a CT scan before applying the IDR technique in all clinical cases. He recognized exposure of the sinus membrane during harvesting as a risk, but downplayed it as not being a significant issue, in his experience.

Dr da Rosa's published paper in 2014 in the International Journal of Periodontics and Restorative Dentistry (IJPRD) following 18 patients with a 58-months follow-up revealed no soft tissue changes or recession postoperatively, and indeed a slight increase in papilla heights over time.