

Updated Clinical and Technical Protocols for Predictable Immediate Implant Placement

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Abstract

Whenever possible and indicated, placing implants immediately after extraction has numerous advantages, including significantly increased patient comfort and immediate esthetics. However, this treatment is highly sensitive to proper treatment planning and execution. Not following the most appropriate and updated protocols meticulously can have detrimental, if not devastating, consequences, especially in the esthetic zone. It therefore is critical to understand and apply fundamental biologic principles and to practice the most advanced and proven techniques for ultimate long-term success. This article introduces a comprehensive and updated protocol for immediate implant placement. Critical steps and considerations from treatment planning to execution with long-term follow-up are described.

Key Words: immediate implant placement, connective tissue grafts, cone beam computed tomography, extraction, 3D bone packing



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Introduction

Restoring both function and esthetics are the ultimate goals of dental treatment.¹ Since the introduction of osseointegration,² endosseous dental implants have become an established and proven treatment option with very high long-term success rates for realizing these goals in partially and fully edentulous patients.³ Whenever possible and indicated, placing implants immediately after extraction into fresh extraction sockets—and restoring them immediately—has numerous advantages, and the success rates for such a protocol are comparable to conventional multistep implant treatment protocols.⁴⁻⁸ Key advantages include significantly increased patient comfort due to elimination of the multiple treatment steps and months-long healing phases, making everything possible in one clinical appointment, and providing the patient with immediate esthetics.⁷ Bone and soft tissue resorption after tooth loss significantly compromise function and esthetics, but can be limited or even prevented by immediate implant placement and restoration.^{7,9,10} However, these clinical treatment options are highly sensitive to proper treatment planning and execution. Not following the most appropriate and updated protocols meticulously can have detrimental, if not devastating, consequences, especially in the esthetic zone.¹¹ It therefore is critical to understand and apply fundamental biologic principles and to practice the most advanced and proven techniques for ultimate long-term success.¹¹

This article introduces a comprehensive and updated protocol for immediate implant placement and describes critical steps and considerations from treatment planning to execution with long-term follow-up. This protocol applies to single, multiple, and adjacent implants.

Clinical Examples and Follow-Up

Figures 1 through 12 demonstrate clinical situations in which this protocol was applied with long-term clinical follow-up.



Figure 1: Preoperative view of #8, showing root resorption.

First Example

In one patient, whose case is shown in Figures 1 through 4, the maxillary right central incisor (#8) had to be extracted due to root resorption (Fig 1) and was replaced by an immediate implant (Fig 2). Figure 3 shows the postoperative clinical situation three years after implant placement. Three surgeries placing connective tissue grafts (CTGs) from the tuberosity (TCTGs) were necessary: one before tooth extraction, one at the time of implant placement, and one three months later. Preoperative and three-year postoperative situations assessed using cone beam computed tomography (CBCT) are shown in Figure 4.

Second Example

The patient depicted in Figures 5 through 8 was involved in an accident, during which both maxillary central incisors (#8 and #9) and the right lateral incisor (#7) suffered severe crown and root fractures (Fig 5). Periapical radiographs document the initial situation in 2006 and the follow-up situation in 2019 (Fig 6). In 2006, two implants were placed immediately at #8 and #9. Tooth #7 was endodontically treated and restored with a direct composite resin restoration. Due to subsequent internal root resorption, this tooth had to be extracted and was replaced by an immediate implant three years later. Figure 7 depicts the clinical situation in 2019. Six months before the photograph was taken, a gingivectomy was performed to level the gingival margins. This was necessary due to tissue creeping after TCTG placement, which is relatively common when the graft is harvested from the tuberosity. Circular CTGs were placed around #8 and #9 in 2006, and both circular and buccal CTGs were placed around #7 in 2009. The CBCT scans from 2019 reveal stable buccal bone around #7 (Fig 8). During implant placement, bone graft material was packed into the space between the implant and the buccal plate. In contrast, resorption of the buccal bone around #8 and #9 was obvious. These implants were placed without any bone graft material.

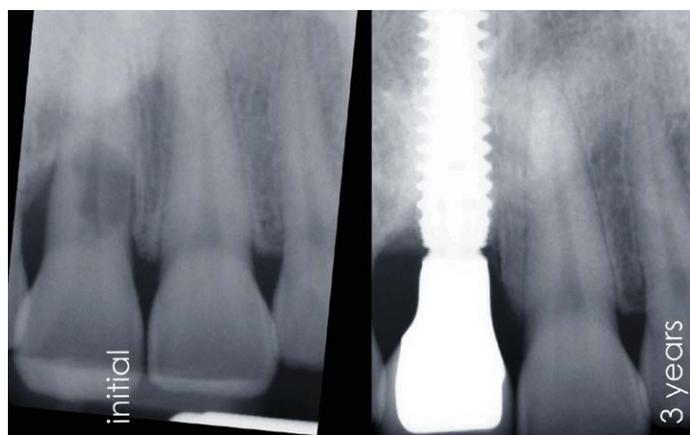


Figure 2: Periapical radiographs demonstrating the initial and three-year postoperative situations.



Figure 3: Clinical situation three years postoperative. Three surgeries placing CTGs were necessary.

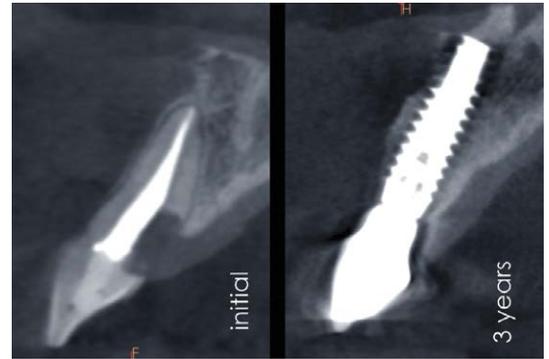


Figure 4: CBCT images of preoperative and three-year postoperative situations.



Figure 5: Severe crown and root fractures to ##7-9.

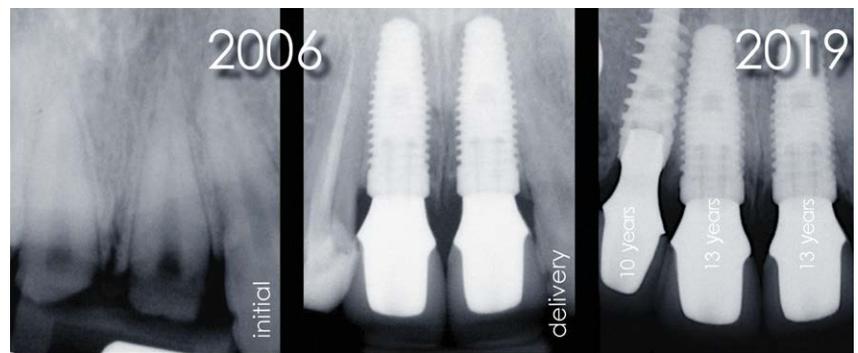


Figure 6: Periapical radiographs of the initial situation, implant placement in 2006, and follow-up in 2019.



Figure 7: Postoperative clinical situation in 2019. A gingivectomy was performed to level the gingival margins six months before the image was taken. Tissue creeping after TCTG is relatively common.



Figure 8: CBCT images from 2019. The buccal bone around #7 remained stable. Bone graft material was packed between the implant and buccal plate during placement. In contrast, resorption of the buccal bone can be seen around the #8 and #9 implants without bone graft material.

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Third Example

In the patient in Figures 9 through 12, the maxillary left central and lateral incisors (#9 and #10) as well as the maxillary right lateral incisor (#7) needed extraction due to periapical inflammation, root fracture (#9), and severe tooth structure loss (#10) (Fig 9). Figure 10 depicts the pre- and postoperative radiographic situations. The treatment result four years later is demonstrated in Figure 11. First, immediate implant placement was carried out to replace #7 and #10. Bone graft material and circular TCTGs were placed on both teeth. Tooth #7 received a buccal TCTG and was restored with a laminate veneer. Three months later, the #9 implant was placed with concurrent three-dimensional (3D) bone packing and a circular TCTG. A closed-flap crown-lengthening procedure was performed on #7. The CBCTs during the implant-planning stage (DTX Studio design software, Nobel Biocare; Yorba Linda, CA) and four years after implant placement are shown in Figure 12. Note the virtual implant planning compared to the actual execution, as well as the buccal bone remodeling. Different screw channel angulations (angulated screw channel [ASC], Nobel Biocare) were selected based on each individual position.



Figure 9: Preoperative intraoral situation; #9, #10, and #7 required extraction.



Figure 11: Postoperative intraoral situation after four years.

The Updated Immediate Implant Protocol

Steps and Sequencing

Planning ahead is the key to success with immediate implant placement into fresh extraction sockets. It is essential that the dental team understand and properly execute every step for predictable long-term esthetic results. There are eight critical steps in this systematic approach (Fig 13):

1. provisional restoration of the tooth to be extracted
2. atraumatic extraction
3. ideal implant placement with surgical guide
4. initial stability above 35-Ncm torque
5. 3D bone packing
6. customized abutment delivery
7. provisional relines
8. TCTG.

Proper sequencing of these steps is fundamental. A provisional restoration is fabricated on the tooth to be extracted, and a final polyvinyl siloxane (PVS) impression and a CBCT scan of the prepared tooth are made. Then, digital evaluation and virtual planning of the ideal implant position are performed on the computer software. A computer-designed surgical guide is 3D printed for implant placement. In the laboratory, a PVS or digital impression is used to create the master model, indicating the prospective implant position through the printed surgical stent.

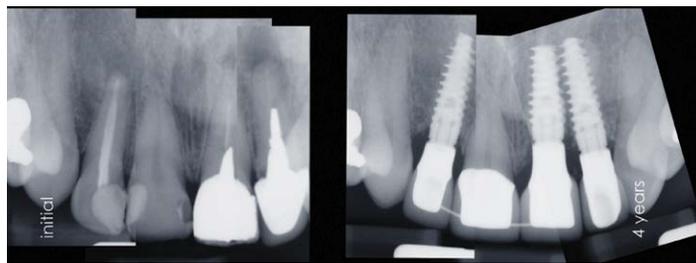


Figure 10: Pre- and postoperative periapical radiographs.

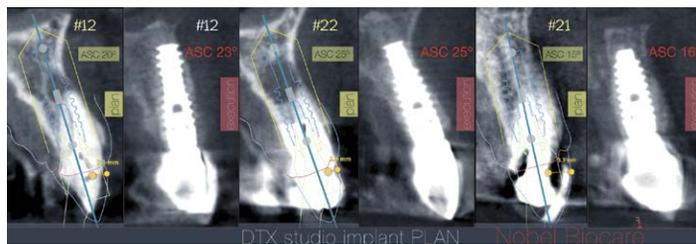


Figure 12: CBCT images during the implant-planning stage and four years after implant placement.

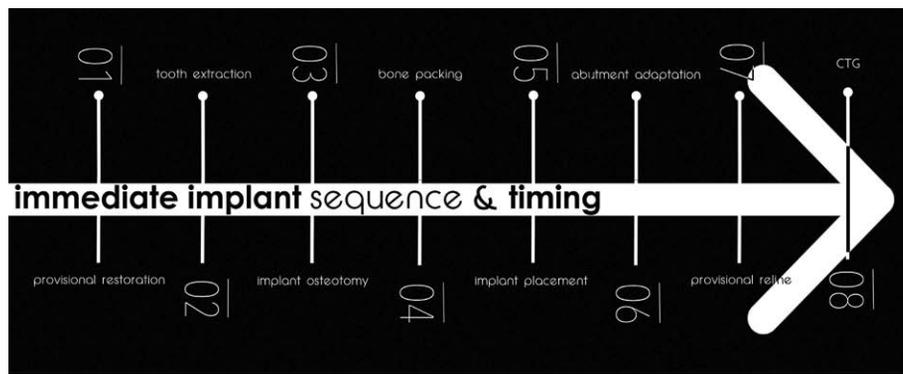


Figure 13: The eight critical steps of the immediate implant protocol.



Figure 14: Clinical and radiographic preoperative situation of a failing #8 in a patient with a high smile line.



Figure 15: Crown preparation of the tooth to be extracted, which was followed by final impression-making and provisional crown fabrication.

Before the surgery, a replica of the prepared tooth is fabricated on a customized abutment on the prospective implant. The surgery starts with an atraumatic tooth extraction and an underprepared implant osteotomy. Xenograft bone substitute material is packed into the socket before implant placement to ensure ideal fill of the gap between the implant and the bony walls. The implant is then placed in an ideal manner through the surgical stent as planned digitally. A customized abutment seals the socket, and the provisional that was placed on the tooth is placed in the proper position with a silicone index matrix and then relined for proper fit. Finally, a TCTG is placed 360 degrees circumferentially to improve the soft tissue phenotype and ensure a long-term esthetic result.

Step 1: Provisional Restoration of the Tooth to be Extracted

Placing a provisional restoration before tooth extraction, no matter the condition of the tooth to be extracted, and before immediate implant placement has many advantages for planning of the implant position and simplified treatment execution. The rationale for placing a provisional crown on a tooth or a root is to provide the patient with pleasing esthetics, but even more so for the clinician to determine the intracrevicular

margin location, soft tissue support, gingival scallop, interproximal papilla, and interproximal contacts, as well as esthetic and functional parameters.

Figure 14 depicts the clinical and radiographic preoperative situation of a failing maxillary right central incisor (#8) in a patient with a high smile line. The tooth was prepared for a crown (**Fig 15**). A final impression was made, and a provisional restoration was fabricated. The provisional restoration should always provide ideal soft tissue support, as the goal is to copy the result achieved with the provisional crown and transfer it to the implant. The intracrevicular preparation finish line becomes the reference point for the implant position depth, which is a crucial aspect of implant placement for an ideal emergence profile and long-term stability of the implant–prosthetic interface. Therefore, two CBCTs typically are necessary: the first to discuss the treatment alternatives based on the current situation, and the second to visualize the preparation finish line on the tooth to be extracted and facilitate the virtual implant planning and positioning in greater detail (**Fig 16**). A final impression will be made with PVS or an intraoral scanner to communicate the location of the subgingival crown margin, the diameter of the tooth, and the prepared abutment characteristics to

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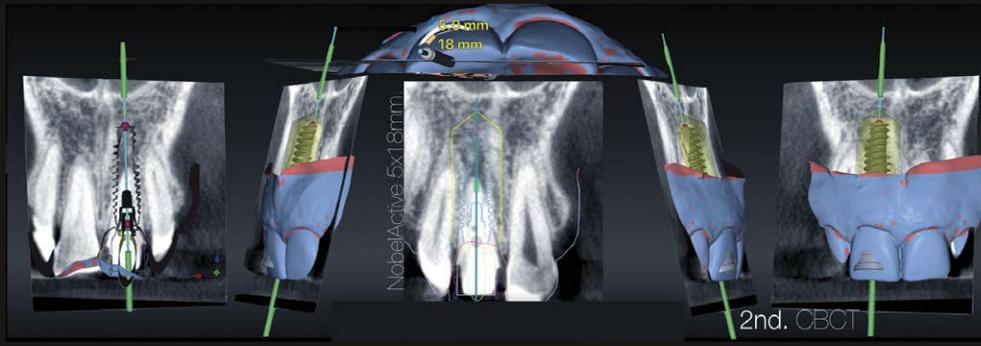


Figure 16: 3D virtual implant planning facilitates precise implant placement. The intracrevicular crown preparation finish line of the tooth to be extracted is critical to determining the depth of the definitive implant position.



Figure 17: The “smart fusion” technique facilitates visualization of the full-contour tooth through a wax-up and model scan for precise virtual implant planning.

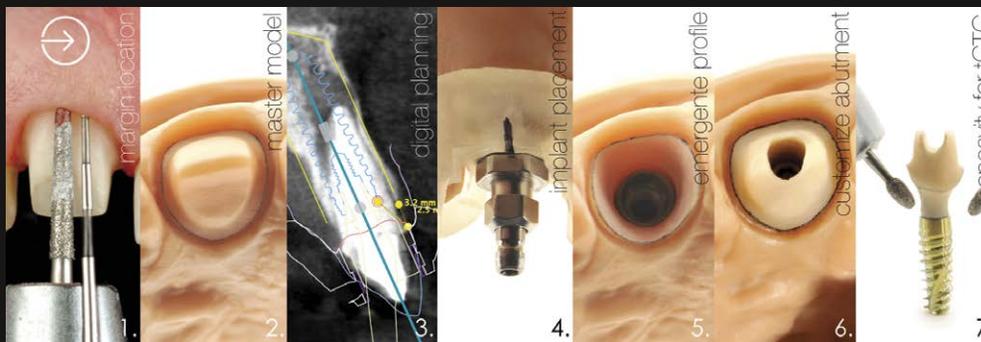


Figure 18: A surgical guide was printed and used to place an implant analog into the master model and transfer the tooth diameter, margin location, and anatomy to the provisional implant abutment. A submarginal concavity was designed to provide space for a CTG.

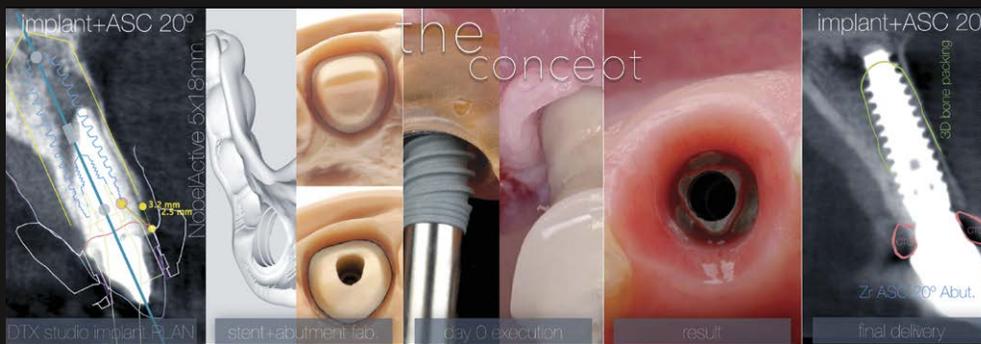


Figure 19: The steps from implant planning to restoration delivery. The abutment also serves as a reference to evaluate the vertical tissue collapse after surgical manipulation and to estimate the necessary CTG volume.

the dental technician. The rationale for these steps is to transfer these critical parameters to the customized implant abutment so as to copy the anatomy of the extracted tooth as closely as possible (Figs 17 & 18). Sealing the socket with an abutment that has the same diameter as the root after tooth extraction and implant delivery provides initial vertical support for the soft tissues that have collapsed during the procedure and supports favorable blood clot formation, together with the circular TCTG.^{12,13} The surgeon also may use the abutment as a reference to evaluate the amount of vertical tissue collapse after surgical manipulation and estimate the necessary CTG volume (Fig 19).

Step 2: Atraumatic Extraction

Success with immediate implant treatment depends on atraumatic tooth extraction, which limits bone resorption and provides predictable outcomes.¹⁴ A fundamental rule is to never place any instrument between the crestal bone and the root;

for example, using the crestal bone as a rest to create the necessary leverage to extract the tooth. Such a technique will damage the crestal bone and directly affect the final result. Instead, the coronal aspect of the adjacent tooth should be used as a rest to create the necessary pressure and leverage to extract the tooth without touching the crestal bone. To facilitate this, it is crucial to cut the root to be extracted vertically in the middle with a diamond bur, creating an internal trough by which to fracture the root vertically with an instrument toward the center (Figs 20 & 21). The central trough creates the space necessary to fracture parts of the root toward the center. This is done by using the adjacent tooth as a rest and the outside boundary of the root to create pressure toward the center until one piece of the root fractures. In general, once the first piece of the fractured root is removed, extracting the remaining part is fairly simple due to the bigger space available to dislodge the root fragment. One could argue as to the orientation of the vertical trough: should

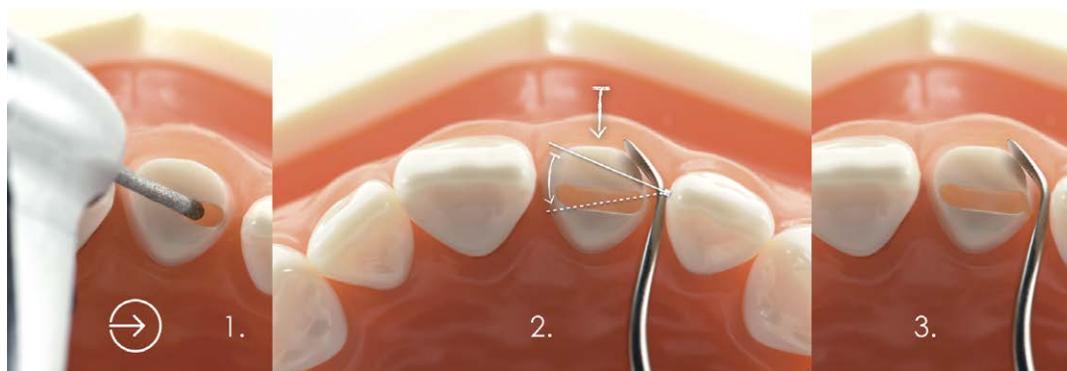


Figure 20: Step-by-step procedure for extraction with a mesiodistal trough. To avoid damage of the bony socket during extraction, the root is cut vertically in the middle with a diamond bur, creating an internal trough. The trough should end short of the peripheral contour of the root to avoid cutting into the bone.

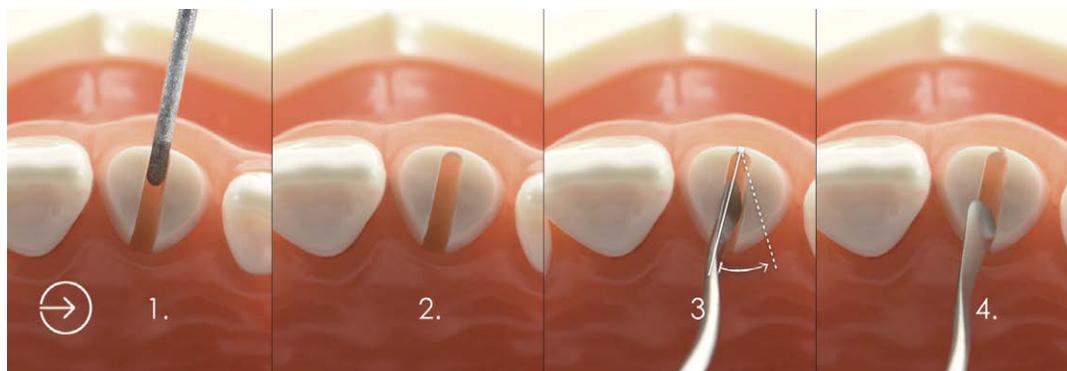


Figure 21: Step-by-step minimally invasive extraction procedure with a buccolingual trough. This has some advantages, as the mesiodistal orientation may not avoid damage to the buccal plate when the root is ankyloused.

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Figure 22: Minimally invasive tooth extraction allows for safe tooth removal without damaging the surrounding bone, which is critical for long-term success with immediate implants.

it be oriented buccolingually or mesiodistally? The advantage of the buccolingual trough is that it decreases the possibility of accidentally fracturing the buccal bone plate during extraction; however, the challenge is to avoid hitting the buccal plate with the diamond bur when cutting the buccolingual trough. Therefore, the trough should not be cut all the way to the buccal aspect of the root; in fact, the trough should never extend all the way through the root but stop about 1 mm short of the bone. With a mesiodistal trough, the chances of causing fractures in the buccal bone are significantly higher, especially in cases where the root is ankylosed to the buccal plate.

The goal is to extract the tooth in the least invasive manner possible. There are some excellent systems and tools available, such as the Benex Pro Bone Preservation Root Extraction System (Meisinger; Neuss, Germany) and the Easy X-Trac System (A. Titan Instruments; Orchard Park, NY). A post is screwed into the root, which is then pulled out of the socket with a lever arm system (Fig 22).

Step 3: Ideal Implant Placement with Surgical Guide

Ideal 3D implant placement has a significant impact on clinical success.¹⁵⁻¹⁹ In the authors' practice, all immediate implants are inserted with a computer- or model-based surgical guide to place the implant precisely with the planned position, angulation, and depth. In-office or in-laboratory 3D printing offers significant time savings and the ability to deliver a customized abutment on the day of surgery. The surgical guide is used to communicate the implant position that was planned on the computer with the dental technician and to transfer it to the master model (PVS final impression of the tooth to be extracted and replaced by the implant).

Traditionally, it has been recommended to place the implant in a more palatal position and at least 2.5 mm away from the buccal plate to be able to fill the gap with xenograft bone substitute material to supposedly support the original bone. In the authors' opinion, a centered implant placement directed

toward the incisal edge and aligned with the same axis as the natural tooth has several advantages and provides better long-term outcomes simply because of its ideal inclination. The relationship between the root positions of maxillary anterior teeth and their respective osseous housing suggests that a vast majority of anterior implants require customized implant abutments with cement-retained restorations.²⁰ Fortunately, engineering has evolved and developed angulated screw channel zirconia abutments with titanium bases that can compensate for up to 25 degrees of implant angulation and allow for screw-retained restorations in a majority of situations (Fig 23). One of the

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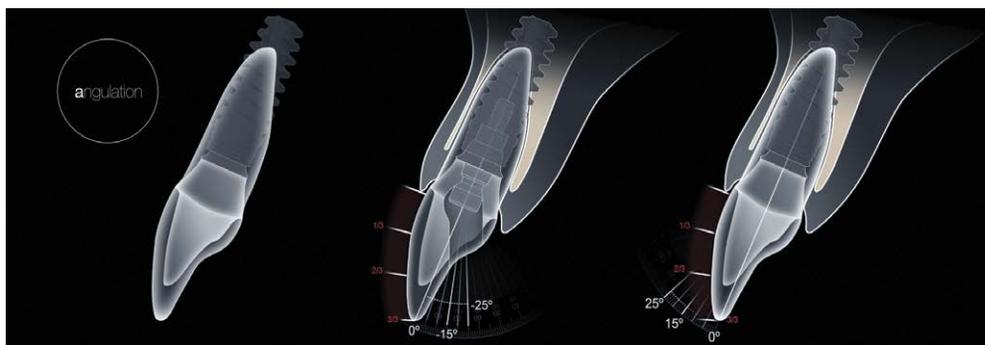


Figure 23: A centered implant placement directed toward the incisal edge and aligned in the same axis as the natural tooth has several advantages and simplifies grafting procedures. Angulated screw channel zirconia abutments facilitate screw-retained restorations, as they compensate for up to 25-degree implant angulation.

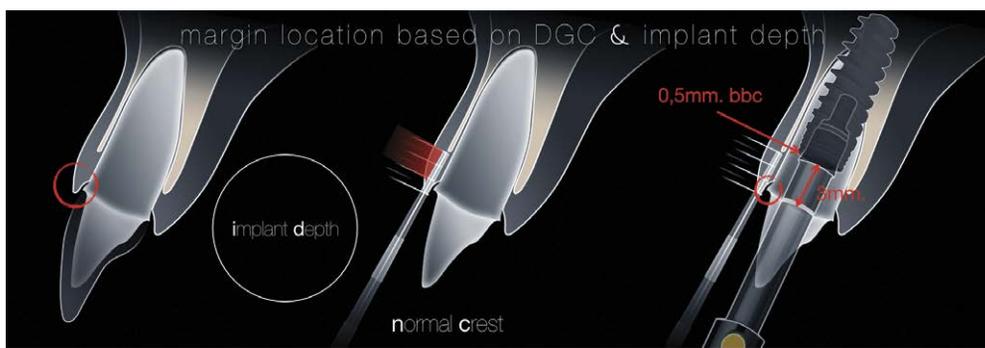


Figure 24: The tooth preparation finish line serves as a reference during virtual implant planning. The depth is verified with the implant carrier during placement of the implant analog in the master model.

main reasons to center the implant is that it is then easy to graft where most needed, which is 360 degrees circumferentially and crestally to the aspect of the abutment that penetrates through the soft tissue. The abutment is designed concavely in this area to accommodate for the tissue graft.

Implant depth related to the buccal bone position is the second most important factor. Typically, the implant head should be placed 0.5 to 1 mm below the buccal bone crest. However, the definitive implant depth is dependent on the dentogingival complex and the desired soft tissue scallop. The preparation finish line of the prepared tooth serves as a reference for the implant depth and can be visualized in the CBCT scan during virtual implant planning (Fig 24). The depth can be verified with the implant carrier when the implant analog is placed in the master model.

Step 4: Initial Implant Stability above 35 Ncm

Implant survival is largely determined by the initial implant stability.²¹ Insertion torque should be 35 Ncm or above, which can be achieved only with proper selection of implant type, shape, diameter, and length.²¹ The narrower the implant, the more

difficult it is to reach the required initial stability. It is easier to reach initial stability with a wider implant, which engages with the interproximal cortical of the socket, but this leaves less space for bone grafting between the bony socket and the implant body.

The initial implant osteotomy is critical for reaching the desired insertion torque value when placing an implant into a fresh extraction socket. The shape of the implant also plays a major role. A self-tapping implant (e.g., NobelActive, Nobel Biocare), featuring a central conical body combined with a parallel external wide-cutting threaded design facilitates high initial stability, which could reach up to 70 Ncm. The cutting, compressing, bone expanding, and, most importantly, reorientation capabilities without major torque loss make this an ideal implant for immediate placement. Figure 25 shows implant and osteotomy bur shapes and dimensions. In the authors' experience, it is recommended never to bypass the diameter of the implant's tip when performing the osteotomy. The macro design of this self-tapping implant allows for placement in all types and for even softer bone, as it functions as an osteotome and bone expander.

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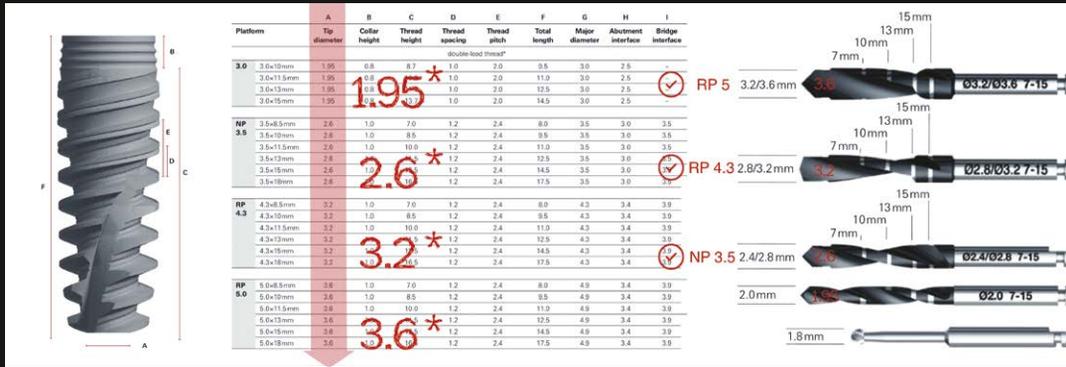


Figure 25: Implant and bur dimensions in the NobelActive implant system. The diameters of implants and tips of the osteotomy burs are indicated in red.

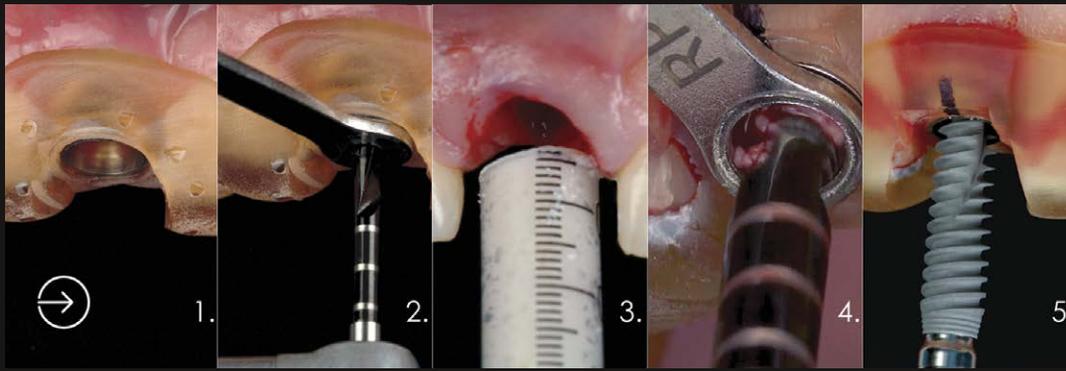


Figure 26: Treatment sequence of osteotomy, 3D bone packing, and implant insertion, always with a surgical guide. The osteotomy is underprepared based on the implant diameter, and xenograft bone substitute material is packed into the socket. Redrilling of the osteotomy site with same drill (without water) and insertion of the implant. Additional bone graft particles are packed into the space between implant and bone.

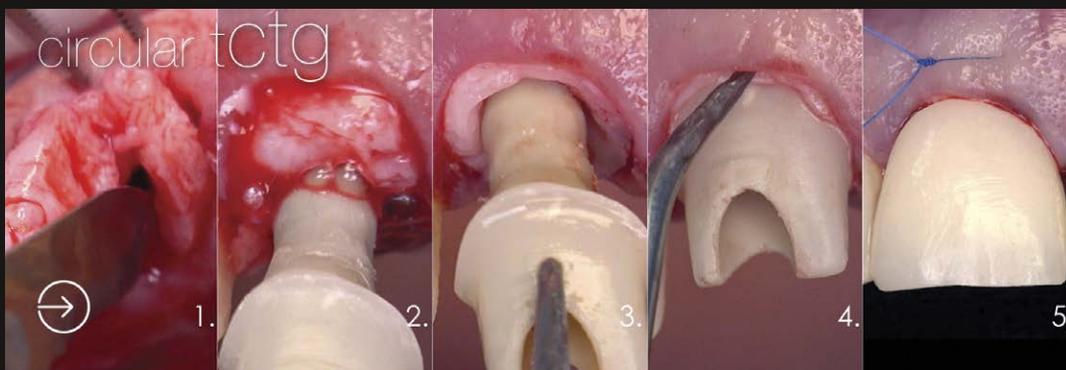


Figure 27: A customized composite abutment is fabricated, and the provisional crown from the original tooth is relined accordingly. A TCTG is placed circumferentially but should not be exposed to the oral cavity due to its poor vascularization. It therefore is sutured in place.

Step 5: 3D Bone Packing

3D bone packing into the space between the socket and the implant body provides support and stabilization of the surrounding bone.^{22,23} While several techniques promote allograft materials, xenograft bone substitute materials are preferred due to their composition, mineral content, and nonresorptive characteristics within the bone matrix. Packing the bone xenograft before implant placement into the underprepared osteotomy site facilitates high initial stability and ensures ideal bone fill in any gap between the socket and the implant. Placing the bone graft material after implant placement makes it more difficult to completely fill all gaps; in addition, the action of packing the particles into the gaps around the implant may damage the ionic implant surface. However, packing the bone particles prior to implant placement requires redrilling of the osteotomy with the same drill used for the initial osteotomy, but without water to keep the particles in place and avoid flushing them out. It is not advised to place the implant “free hand” into the bone particle-filled socket, since socket configuration and particle resistance may deviate the implant in an unexpected manner.

Using the surgical guide as a guided cylinder mount on the implant against the ring embedded into the computer-based surgical guide will ensure precise implant positioning without any distortion from the bone graft particles in the socket. Once the implant is in its ideal position, the space between the implant body and the bone is filled with bone graft material. Additional xenograft material to compact the particles even more is packed into the space and condensed to a paste-like consistency. **Figure 26** shows the treatment sequence.

Step 6: Customized Abutment Delivery

A customized implant restoration that copies the anatomy of the extracted tooth is necessary to seal the socket and protect the tissue grafts. This can be done with a customized healing abutment and a crown bonded to the adjacent teeth and resting on the abutment, with a customized implant abutment and a cement-retained provisional crown, or with a screw-retained restoration. A customized abutment and cement-retained provisional restoration is the authors' preferred solution, as this facilitates the versatile adaptation of the crestal CTG, which will be placed as the last step of the immediate implant protocol. A customized implant abutment that represents an exact copy of the prepared tooth to be extracted and the hollowed-out and relined tooth provisional already have all the necessary features in terms of shape, esthetics, occlusion, soft tissue support, interproximal contacts, and shade. Sealing the socket in such a manner protects and retains the blood clot and the CTG.

The abutment is fabricated with a blend of the information from the CBCT and the final impression of the tooth. From the CBCT and the software's “smart fusion” feature (fusing scans of the final impression master model and the full-contour wax-up), the ideal implant position is transferred with a computer-designed surgical guide to the master model. The dental technician drills or hollows out the site of the tooth to be extracted

and then transfers the exact implant position with the guided cylinder or guided implant insertion mount into the position of the extracted tooth. A temporary plastic abutment is placed onto the implant analog and adapted to fit the silicone matrix made from the original tooth. Then, composite is placed between the carved emergence profile of the tooth and the temporary plastic abutment to transfer the diameter and location of the tooth preparation finish line. Once the provisional composite abutment is finalized, there is the option to scan it and fabricate the final zirconia abutment. Following the “one abutment–one time” concept, the final zirconia abutment is placed during the surgery and never removed. However, the space that can be created for the CTG with the concave abutment design is limited due to the screw access hole and the minimal thickness necessary for sufficient zirconia abutment strength (**Fig 18 [last step]**). A composite abutment allows for a more pronounced concavity and greater space for the circumferential CTG without compromising structural integrity (**Fig 27**). Using a plastic temporary abutment is preferred over a titanium one since the heat created through the possible necessary adjustments may cause delamination of the customized composite from the titanium substructure.

Step 7: Provisional Reline

Once the implant is placed with the computer-designed surgical guide, its exact position needs to be transferred to the position of the implant abutment precisely as fabricated on the master model. The buccal position of the flat hex on the implant head is marked on the surgical guide with a pencil or marker. The

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Figure 28: Initial, one-week, and three-month follow-up clinical situations.

original provisional restoration that was placed on the tooth is hollowed out and relined in the exact same position on top of the prefabricated customized abutment with a silicone matrix. The advantage of using the same provisional again is that it already features all the necessary anatomical, functional, and esthetic parameters. After the provisional restoration is relined, the crown-abutment complex is removed and polished chairside for delivery after CTG placement (**Fig 27**).

Step 8: TCTG

Soft tissue augmentation with subepithelial CTGs is recommended for all, and especially immediate, implant procedures, even for thick tissue biotypes.²⁴⁻²⁹ CTG placement is the final step of the immediate implant treatment protocol. This timing allows for better control of the space that needs to be filled with soft tissue. This space is dependent on the dimensions of the root and the concavity of the abutment, which is limited by the screw access hole and the material selected (plastic, metal, or zirconia). Other reasons to place the CTG at the end of treatment is to avoid contamination of the graft during the other procedures, but mainly to avoid desiccation of the graft and to make the procedure faster.

The donor site of the CTG is arguably the most important factor for long-term soft tissue stability. The palatal mucosa has traditionally served as the favored connective tissue donor site.³⁰ Its thickness, however, varies significantly among patients and is limited by anatomical structures such as the greater palatine artery,³¹⁻³⁴ and healing typically is associated with significant discomfort.³⁵ The area of the maxillary tuberosity as a donor site for subepithelial CTGs was first described in 2001.³⁶ It offers greater and more consistent tissue thickness, and its successful application has been confirmed both histologically and clinically.³⁷⁻³⁹ Connective tissue from the tuberosity is ideal due to its high content of dense collagen fibers and little or no fat, which causes less resorption and improves the quality of the grafted

site due to the genetic expression from this part of the mouth compared to the palate.³⁷⁻³⁹ Due to its histologic characteristics, a TCTG should not be exposed to the oral cavity and must be covered with a closed tissue flap. Its poor vascularization will cause necrosis of any exposed TCTG.^{40,41}

The TCTG is placed in two different ways: a circular CTG in all cases, or a buccal and circular CTG in situations of thin tissue or buccal plate dehiscence. When the buccal plate is 1 mm or thicker, a circular TCTG is sufficient; however, when the buccal plate is thin or insufficient due to moderate dehiscence, two TCTGs should be placed: one circular around the abutment, and one on the buccal aspect of the buccal plate with a partial-thickness flap tunnel to accommodate the graft.

A circular TCTG is placed in all immediate implant cases to improve the tissue phenotype and to create a dense and stable protection of the implant abutment–soft tissue interface. This circular CTG is cut to be packed underneath the concave allocated prosthetic space below the implant abutment finish line. Normally, sutures are not necessary since the abutment keeps the TCTG and the corresponding blood clot in place and protects them (**Fig 27**). When necessary, the buccal TCTG consists of a layer of 1 to 2 mm of thin tissue. It is placed into a partial-thickness buccal pouch on the labial aspect of the buccal plate and sutured internally to the buccal flap. The position of the buccal TCTG should be as coronal as possible to allow it to be tugged into the allocated prosthetic concave space left on the implant abutment. The concave aspect of the implant abutment must accommodate the two independent TCTGs to thicken the buccal tissues.

Final Delivery and Long-Term Results

After three months of healing (**Fig 28**) and the implant planning and placement (**Fig 29**), a final PVS pick-up impression was made with the provisional restoration and poured chairside with the provisional restoration, provisional abutment, and im-

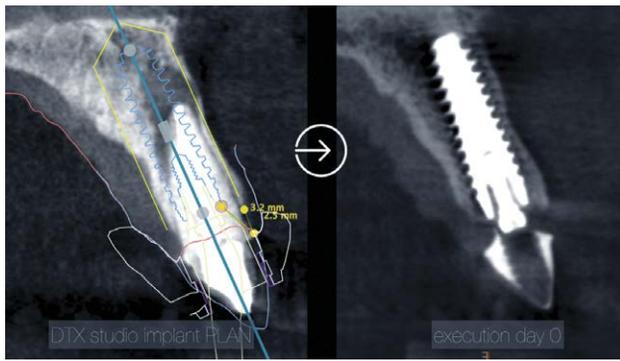


Figure 29: CBCT with virtual implant planning and after implant placement.

plant analog connected. After stone setting, the provisional abutment and crown were removed, cleaned, and disinfected with 2% glutaraldehyde before being placed back into the patient's mouth. An ASC zirconia abutment with a 20-degree angulation was fabricated digitally, and porcelain layering was applied until a perfect match of the restoration with the adjacent teeth was achieved (Fig 30). While the zirconia ASC abutment was slightly wider than the provisional composite abutment due to the titanium base, all other aspects of the definitive restoration followed the design of the provisional restoration (Fig 31). Since the definitive restoration is a copy of the original tooth and root, its delivery is greatly simplified. It is advisable to splint the teeth adjacent to the implant to prevent their extrusion (Fig 32). Preoperative and three-year postoperative clinical and radiographic situations are depicted in Figs 33a-34.



Figure 30: ASC zirconia abutment with a 20-degree angulation. The porcelain was layered to match the restoration of the adjacent teeth.



Figure 31: The ASC abutment is slightly wider than the provisional composite abutment due to the titanium base. All other aspects follow the design of the provisional restoration.

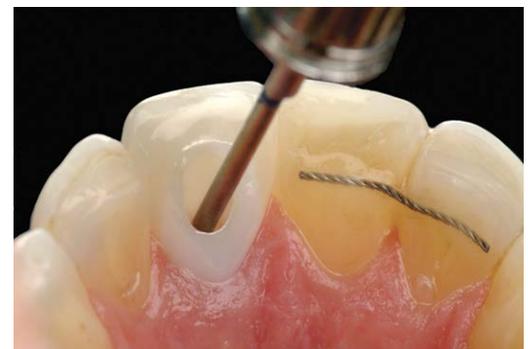


Figure 32: The teeth adjacent to the implant are splinted to prevent extrusion.

CLINICAL COVER FEATURE



Summary

The comprehensive protocol described and illustrated in this article, from treatment planning to execution with a multiyear follow-up, provides updated guidelines for long-term functional and esthetic clinical success with immediate implant procedures. However, meticulous realization of the critical steps and techniques is critical to achieving these outcomes predictably and on a routine basis.

!! **Connective tissue from the tuberosity is ideal due to its high content of dense collagen fibers and little or no fat, which causes less resorption and improves the quality of the grafted site due to the genetic expression from this part of the mouth compared to the palate. !!**



Figures 33a-33f: Preoperative (a-c, left) and postoperative (d-f, above) views.

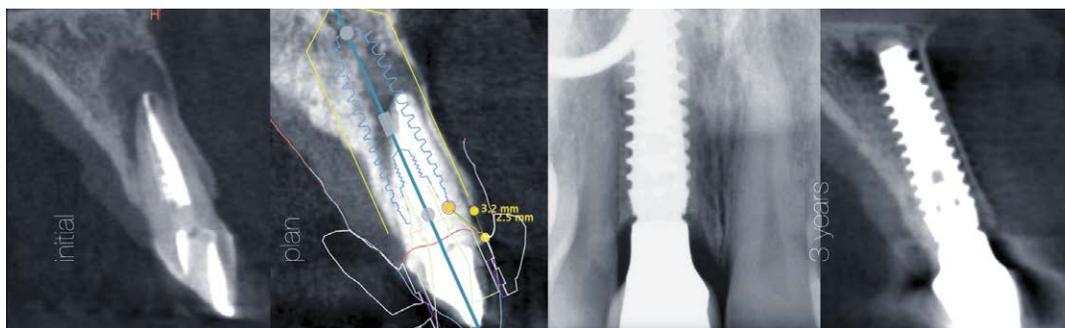


Figure 34: Radiographic documentation: initial situation, virtual implant planning, and situation at three-year follow-up.

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