Preservation-Driven Surgical Protocol

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ABSTRACT

The world of implantology is in a perpetual state of evolution. Even the concepts of implant therapy have undergone many paradigm shifts, from focusing on the osseointegration of dental implants to establishing predictable therapy protocols. Of late, one of the biggest driving forces behind such change is advancing technology. Advancing technologies have enabled the improvement of implant fixture designs. Such advancements have reverberated across implant systems world-wide, riding the digital wave to the point of birthing their own niche in digital implantology.

Through the case presented in this article, the concept of preservation-driven implantology will be shared using a modern understanding of implant design and implantology concepts.



INTRODUCTION

Over the past half a century, we have witnessed the evolution of implant dentistry: once it was considered as an experimental trial, whereas now it is considered to be one of the most predictable treatment modalities in the war against edentulism.[9] In fact, it is a treatment modality with significant functional and biological advantages, supported with numerous 10-year studies with success and survival rates above 95%.[1,2] There is no doubt that professor P. I. Brånemark from the University of Gothenburg (Sweden) pioneered the world of implantology[3], but soon after, many clinicians and researchers world-wide followed his footsteps to further refine treatment protocols. Because of these many committed individuals, the treatment of choice against edentulism is now dental implants.

During the 1990's, paradigm shift took place, especially in the areas of surgical protocols and implant designs. Those changes led to improvements which include refinements in guided bone regeneration protocols[4,5], immediate implant therapy[6], implant surface treatments, and implant body design changes[7]. With such advancements in implantology, our profession is now at a point where we evaluate the success of implant therapy not from a perspective of successful osseointegration, but from perspectives of successful aesthetic and functional outcomes.

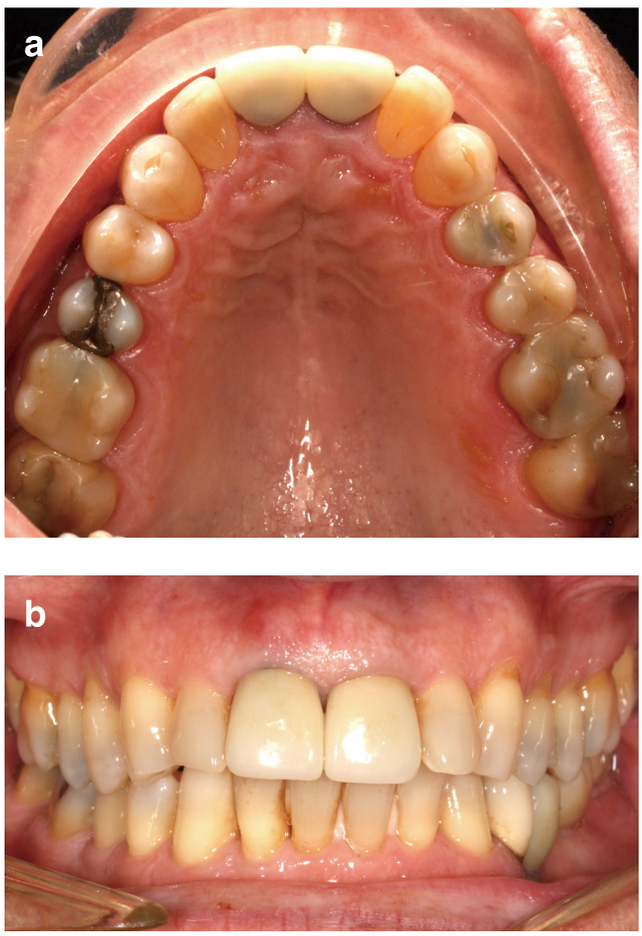
In this article, immediate anterior implant therapy was provided using the MegaGen AnyOne implant system. Immediate implant therapy was employed in order to preserve the peri-implant architecture and to minimize changes from the pre-operative state: the preservation-driven immediate implant therapy. Therefore, this article will highlight the benefits of the contemporary concepts of the implant design and surgical protocols that were utilized.

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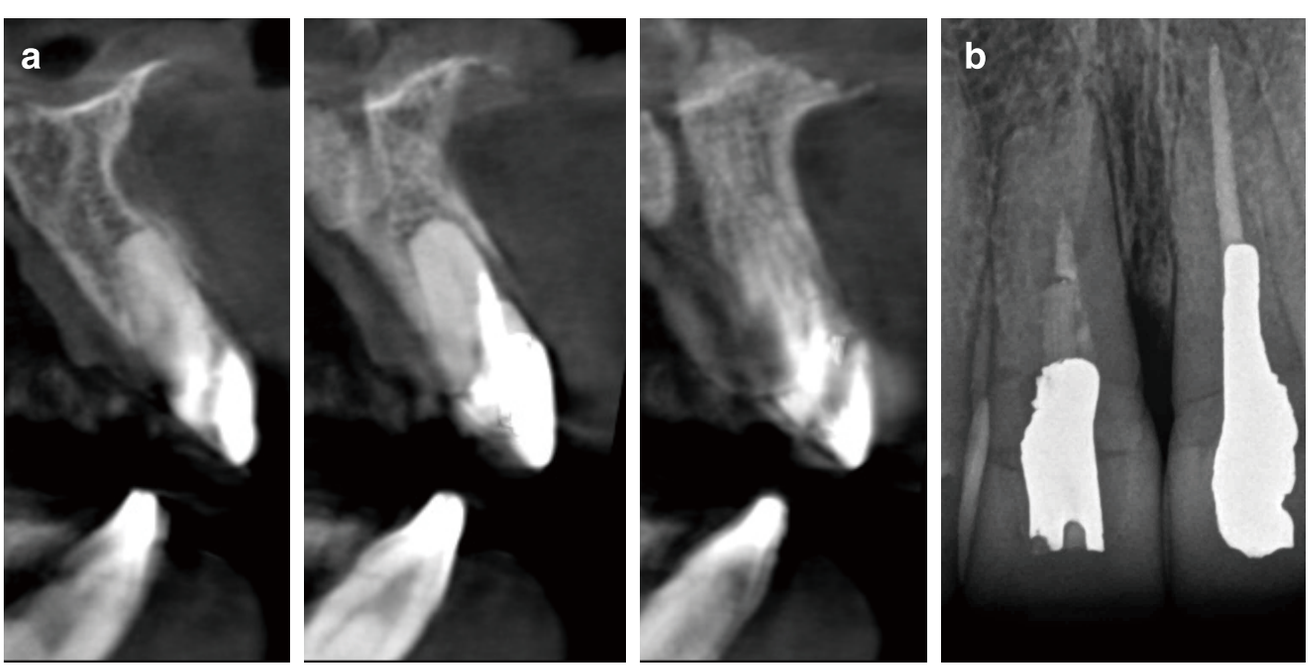
PATIENT EVALUATION

A 59-year-old male presented with pain on biting and occasional discomfort from tooth #11 (upper right central incisor). A peri-apical radiograph evaluation revealed that the upper right central incisor had been previously root canal treated with inadequate instrumentation. (Figure. 2b) The patient was referred to an endodontist for possible retreatment of the root canal system; however, the endodontist diagnosed this tooth to have a vertical root fracture (VRF) and recommended that the tooth be extracted and replaced.

The patient's medical history revealed the following: a daily cannabis user; diagnosed with osteoarthritis; otherwise, healthy with no known drug allergies. The patient had a generally healthy stable periodontal status with some gingival recession that had been stable for a number of years. Cone beam computed tomography (CBCT) revealed no periodical radiolucency with an adequate amount of bone for immediate implant therapy. (Figure. 2a) After thorough consultation, the patient agreed to proceed with immediate implant therapy.



Figures. 1a & 1b: *Pre-op intra-oral photo of patient. Note erythema on tooth #11 (upper right central incisor), which was diagnosed to have vertical root fracture.*



Figures. 2a & 2b: *Pre-op cone beam computed tomography (CBCT) and periapical radiograph of tooth #11. Note inadequate root canal treatment with buccally positioned core.*

SURGICAL PROTOCOL

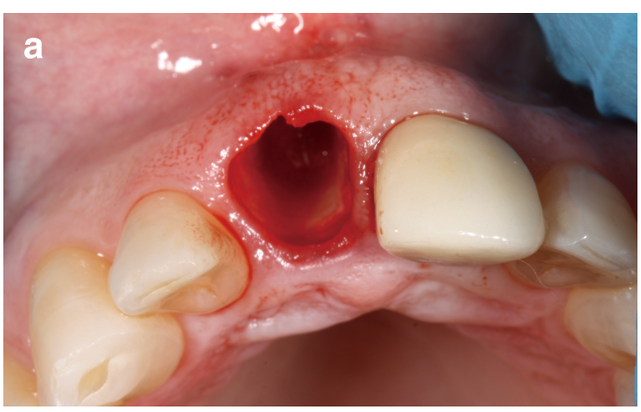
A pre-operative antibiotic (amoxicillin, 2.0g) was given to the patient 1 hour before their surgery. The patient was also instructed to rinse his mouth with a 0.12% chlorhexidine gluconate solution twice a day, to start one day before the surgery and to continue for 2 weeks afterwards.

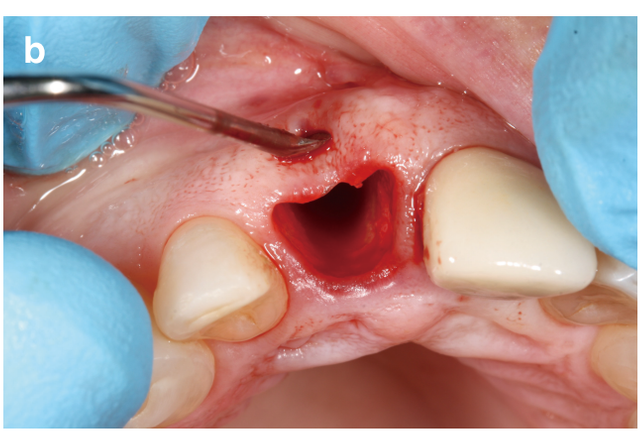
After administering a local anesthesia (4% articaine with 1:200,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine), platelet-rich fibrin (PRF) was obtained from the patient. The PRF was obtained for two reasons: sticky bone formation for dual-zone grafting, and a PRF membrane to help seal the socket with a provisional restoration. The tooth was then extracted with as minimal trauma as possible: proximators were used to luxate the tooth and surgical forceps utilized with rotational movements. Note, no flaps were raised in the process. A small tear occurred on the buccal gingiva during the extraction process. (Figure. 3a)

After extracting the tooth, the socket was thoroughly debrided using surgical excavators and surgical burs. Once the socket was fully debrided, the buccal wall was found to be missing, likely due to previous surgery, which was also evident from the CBCT. (Figures. 2a & 3b)

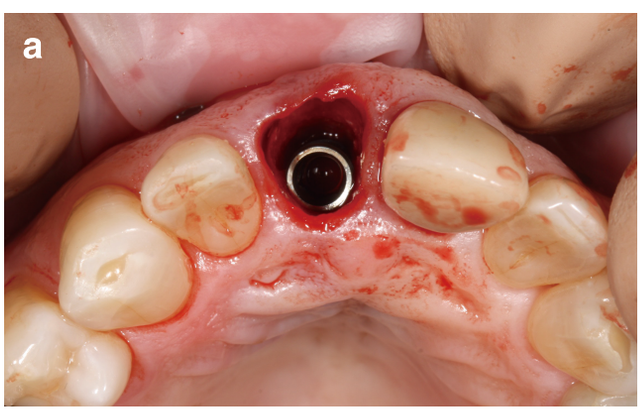
Once the tooth socket was thoroughly cleaned, an osteotomy was created in the socket. The osteotomy site was positioned palatally to achieve two goals: to create a jump gap between the implant fixture and the future buccal plate for dual zone grafting, and to achieve cingulum prosthetic screw access. (Figure. 4a) Next, a MegaGen AnyOne 4.0 mm x 13 mm implant fixture was inserted. An insertion torque of 50Ncm was achieved, and an adequate depth of placement was confirmed. (Figure. 4b)

After achieving the two above criteria, the author proceeded with fabricating an immediate provisional restoration. The jump gap was grafted with allograft (MinerOss, BioHorizon) mixed with PRF as sticky bone. (Figure. 5a) the dual zone grafting concept[8] was applied in this case.



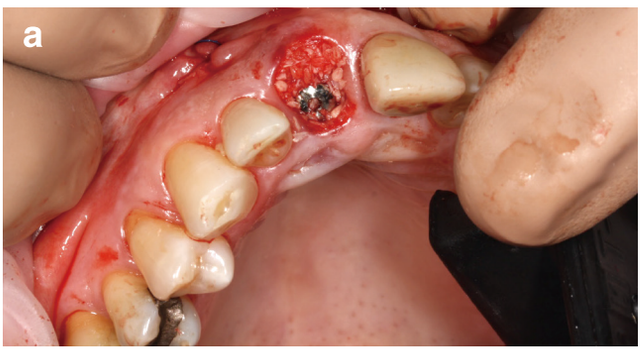


Figures. 3a & 3b: *Post-extraction socket of tooth #11. Note missing buccal plate*





Figures. 4a & 4b: *Intra-operative photos after implant fixture insertion. Adequate insertion torque (50Ncm) was achieved*





Figures. 5a & 5b: *Post-extraction socket of tooth #11. Note missing buccal plate*

PROVISIONAL PHASE

A MegaGen AnyOne temporary cylinder was used to fabricate the immediate temporary restoration. A PVS putty impression was fabricated pre-operatively as a matrix for the temporary restoration. Once the temporary cylinder was connected with the implant fixture, a PVS putty matrix was filled with temporary acrylic material (Structur 3, Voco) and seated over the surgical site. A PRF membrane was also used as a barrier between the acrylic and the grafted sticky bone. Once the temporary materials were set, the matrix and excess materials were removed.

The subgingival contour was re-created using a flowable composite. The overall appearance and contour of the temporary restoration were shaped using diamond and carbide burs on both slow- and high-speed handpieces. (Figure. 6) Once the restoration was fully shaped, the surface of the temporary restoration was polished with finishing burs. After completing the temporary restoration fabrication, the temporary restoration was placed back on the fixture with a PRF membrane. (Figure. 5b) This temporary restoration was torqued to 25Ncm and a postoperative radiograph taken. (Figure. 8a)

It is noteworthy to highlight the importance of this temporary restoration to the final outcome. The subgingival contour of the temporary restoration will directly translate to the emergence profile of the final restoration. Thus, creating a proper emergence profile is paramount to developing adequate support for the soft tissue profile and bone graft stability. These conditions yield a successful outcome. The occlusion was adjusted so that the temporary restoration was not in contact during excursive movements and at the maximum intercuspation position. (MIP)

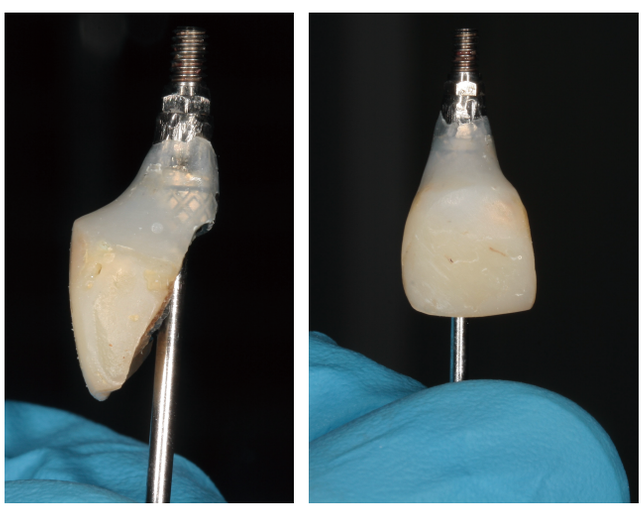


Figure. 6: *Shape of temporary restoration before polishing. Note subgingival contour, intended to re-create proper emergence profile for final restoration*

" ...creating a proper emergence profile is paramount to developing adequate support for the soft tissue profile and bone graft stability. "

POSTOPERATIVE PHASE

The patient was instructed to rinse twice a day for 1 minute with a chlorhexidine solution and to avoid any mechanical means of cleaning at the surgical site for 2 weeks. The suture, which was placed in the vestibular area where a fistula was present on the day of surgery, was removed after 2 weeks.

The patient returned to the clinic after 4 months of healing for the final prosthetic phase. The temporary was removed, the ISQ was measured (ISQ value: 80, 79), and a custom impression with open tray impression coping was utilized to fabricate the final implant-supported SCRC crown. A periapical radiograph was taken to confirm the full seating of the custom impression coping. (Figure. 8b) The final crown was fabricated using CAD/CAM technology, and the material of choice in this case was a porcelain-fused zirconia crown with an anodized custom titanium abutment. (Vista Dental Studio; New Westminster, Canada) The final crown was inserted and torqued to 35 Ncm, as recommended by the manufacturer. A periapical radiograph was taken to confirm the full seating of the restoration. (Figure. 8c)



Figure. 7: *2-week post-operative photo of surgical site. Note fistula is still healing.*



Figure. 7: *Photo of final implant-supported crown on day of delivery. Note healing of peri-implant soft tissue.*

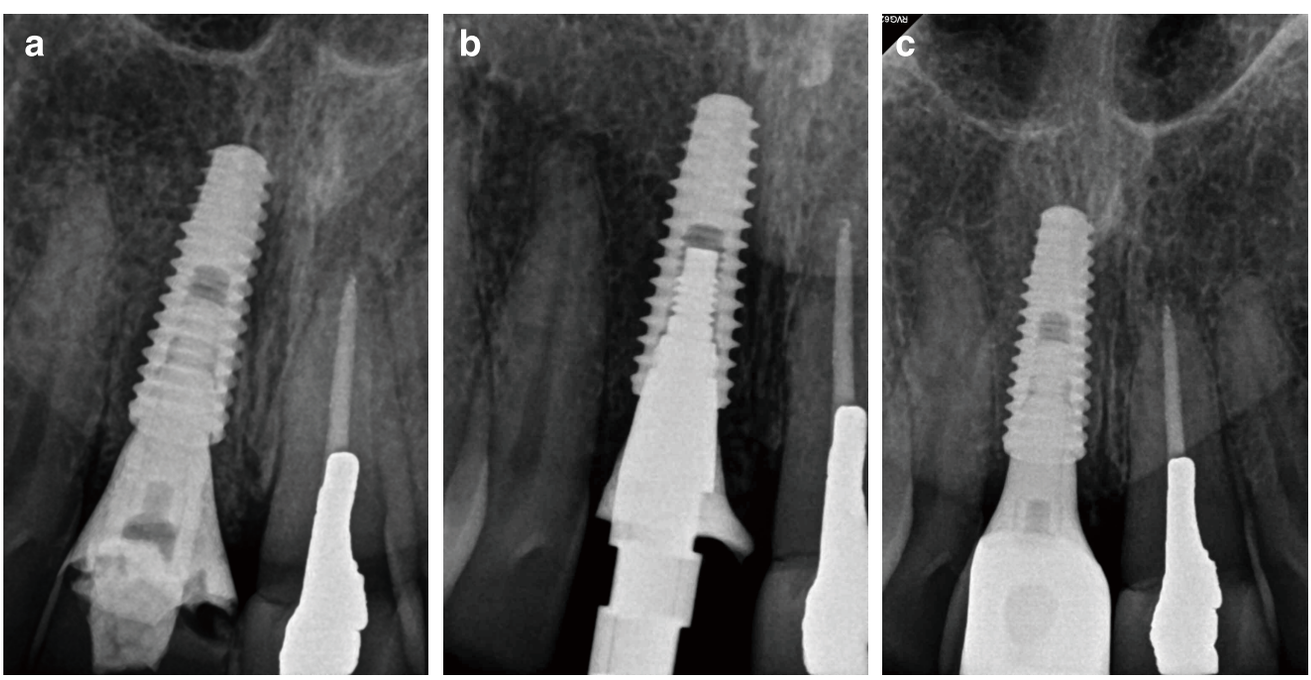


Figure. 8

a) Immediate post-operative periapical radiograph of temporary restoration.

b) Periapical radiograph to confirm full seating of custom impression coping for open-tray impression technique

c) Periapical radiograph to confirm full seating of final restoration. Note preservation of emergence profile from temporary to final restoration.

DISCUSSION

Implant therapy, especially single tooth implant treatment, has become a highly predictable treatment option for edentulism. With efforts from both researchers and clinicians, we are now fortunate enough to be able to offer predictable treatment with fewer surgeries. This section will highlight the important concepts utilized to achieve such results.

IMPLANT DESIGN

The traditional Brånemark implant design started with a cylinder-shaped implant with a machined surface and external hex connection. With a number of paradigm shifts in implant technology, modern implant design has changed significantly, as reflected in the design of the MegaGen AnyOne system.

First, the MegaGen AnyOne system has a straight-taper design. The apical-end design of the AnyOne system allows the implant fixture to achieve a high insertion torque during immediate implant therapy, which is one of the criteria for successful immediate implant therapy. Also, its Knifethread design allows better engagement with bone with an increased bone-to-implant contact (BIC), contributing to a higher insertion torque and primary stability; again, one of the important factors for successful immediate implant therapy. MegaGen's unique SLA surface with Xpeed surface coating enhances the healing of the peri-implant bony architecture to improve the secondary stability of the implant fixture. And last, but not least, an internal conical connection with a platform-shift allows the peri-implant bony level to be maintained adequately. While adequate clinical success can be achieved with a traditional Brånemark implant design, the advancements in implant design and technology definitely aid in achieving more predictable outcomes with immediate implant therapy. These advances are also reflected in the AnyRidge system.

Similarly, the new BLUEDIAMOND implant line-up (Figure. 9) is another system with great prospects. The BLUEDIAMOND implant fixture has an improved design with a higher compressive strength, more precise prosthetic connection, and the AnyRidge concept built into the system.

The author believes that the BLUEDIAMOND implant system is another great implant system from MegaGen, and will greatly assist with the preservation-driven immediate implant therapy concept, especially with its more tapered apical end, allowing the implant fixture to engage narrower osteotomies for a higher insertion torque.

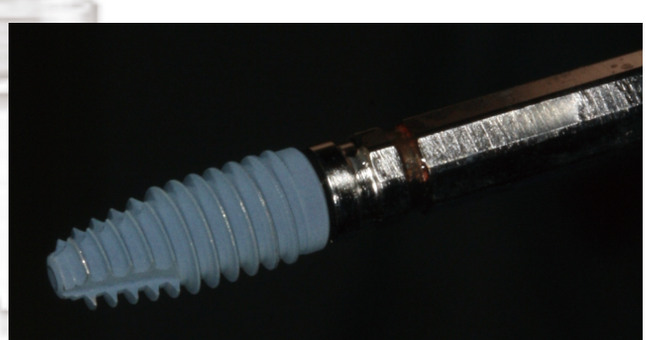


Figure. 9: *BLUEDIAMOND implant fixture (4.1 mm x 11.5 mm).*

DUAL ZONE GRAFTING

The extraction of a tooth inevitably leads to hard and soft tissue morphology changes. A number of techniques have already been suggested in literature to minimize such morphological changes during immediate implant therapy: connective tissue grafting, socket-shield/ partial extraction technique, and dual-zone grafting.

Dual-zone grafting was first introduced by Dr. Stephen Chu and his colleagues in 2012.[8] Essentially, the dual-zone grafting concept suggests that the buccal contour changes from immediate implant therapy can be limited by placing bone graft materials in both the bone zone and the soft tissue zone. Chu and his colleagues listed the following critical clinical keys that must be respected:

- Atraumatic tooth removal without flap elevation
- Placement of bone graft into bone and tissue zones in residual gap around immediate fresh socket implant, with screw-retained provisional restoration acting as prosthetic socket seal device.

Chu and his colleagues suggested that when dual-zone grafting is performed successfully, the morphological changes of the extraction site can be minimized and potentially enhance the thickness of the peri-implant soft tissue coronal to the implant-abutment interface.

In the current case, the dual-zone grafting successfully maintained the peri-implant morphology. (Figure. 10a & b) The CBCT also revealed adequate re-creation of the buccal plate and adequate healing of the surgical site; it is noteworthy to point out the formation of a corticated buccal plate above the implant platform. (Figure. 11a & b)

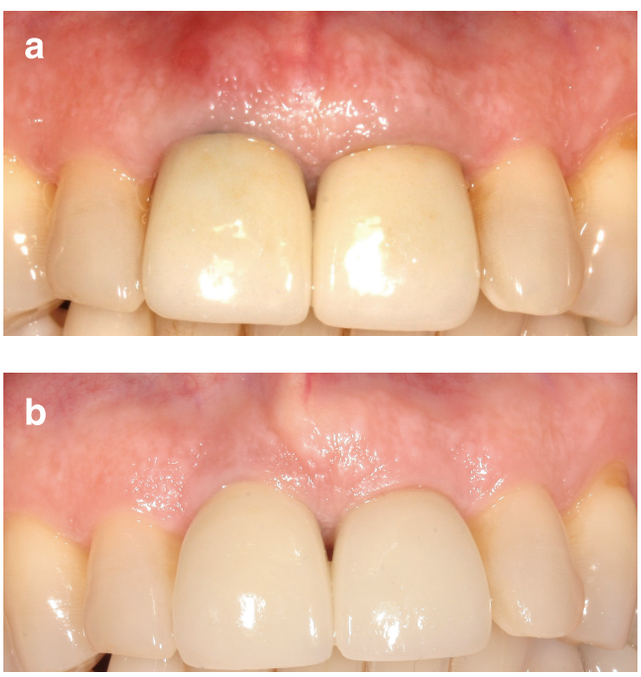


Figure. 10:
a) Pre-operative photo of surgical site.
b) 2-year follow-up of surgical site. Note upper left central incisor (#21) has also been replaced with immediate implant therapy, utilizing digital implantology including R2Gate. Note preservation of soft tissue architecture

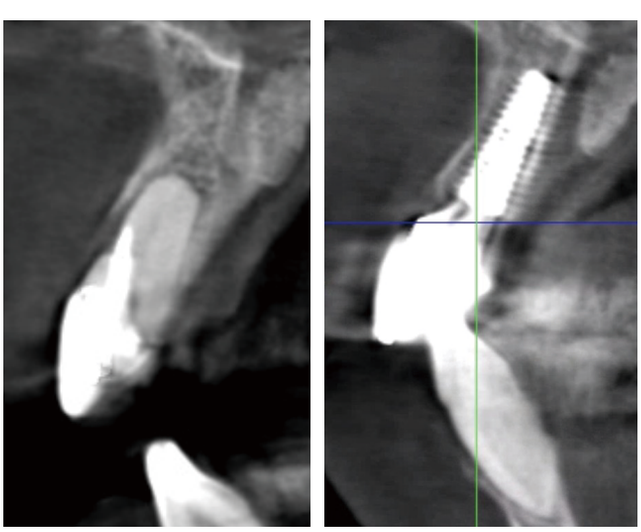


Figure. 11a & b: *Pre-op & 2-year post-operative CBCT of surgical site. Note buccal plate reformation of surgical site with cortication, extending beyond implant-abutment interface.*

It could be argued that the black triangle between #11 and 21 could have been addressed prosthetically. However, the patient did not wish the black triangle to be addressed and was happy with the results, as the patient's natural smile line does not show the black triangle. (Figure. 12)



Figure. 12: *Patient's natural smile-line*

It should be emphasized that the dual-zone technique is not the only way this tooth could have been treated. For example, soft tissue grafting could have been utilized to enhance the soft tissue thickness. However, a socket shield would not have been possible due to the buccally angled post that would have interfered with creating an adequate socket shield for the site. In other words, it is important to understand the indications and applications of each technique, and utilize such techniques in a way that benefits both the clinician and the patient in terms of the surgical process and clinical outcomes.

SUMMARY

In aesthetically demanding situations, implant therapy or any type of tooth-replacement therapy should be performed with caution and planned thoroughly. Sometimes, clinicians get caught up with re-building excessive bone or soft tissue in order to counteract the possibility of site shrinkage or changes in the peri-implant morphology. The author does not believe that such an approach is wrong; however, it is the author's opinion that, with careful case selection, aiming to preserve "that which is present" involves a much simpler surgical approach. This approach yields a favourable outcome without the need to employ sophisticated surgical processes, which themselves can introduce greater risks for co-morbid treatment complications.

Immediate implant therapy in the anterior region has already been well documented in literature for its successes. Thus, it is now generally accepted as a viable and predictable treatment modality for many clinicians around the world.

Therefore, acknowledgement must be given to the many researchers and clinicians who have tirelessly contributed to advancements in implant technology, designs, and protocols to make immediate implant therapy a viable and predictable option. Notwithstanding, it should also be strongly emphasized that immediate anterior implant therapy is a technique-sensitive protocol that requires careful case-selection and thorough planning.

" Acknowledgement must be given to the many researchers and clinicians who have tirelessly contributed to advancements in implant technology, designs and protocols... "

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