The management of immediate implant placement to optimize aesthetic outcome in the anterior maxilla

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Introduction
Following tooth extraction the implant surgeon may select between various implant placement timing and loading protocols.¹ Ideally these are to be determined prior to extraction, be it immediate (type 1), early (type 2, 3), or late placement (type 4).² Immediate implant placement even in the aesthetic zone is a literature supported treatment modality with success comparable to alternative placement protocols.³, ⁴ Immediate placement reduces the number of surgical interventions, shortens time to final restoration, may offer a fixed provisional restoration alternative to a removable interim prosthesis, and may partially support the peri-implant tissues prior to collapse from the extraction socket remodelling.⁵⁻⁸ Certain clinical criteria however need to be met in order to achieve a successful treatment outcome, namely: intact extraction socket walls, facial bone residual at ≥ 1 mm, thick gingival biotype, absence of acute infection, and sufficient residual bone at the palatal and apical tooth socket.⁹ Compromising on these criteria may lead to aesthetic complications in the long term, even if functional survival is maintained.¹⁰ Midfacial soft tissue recession is a common complication with an average of 1 mm loss to be expected in most immediate implant cases.⁹ Ridge collapse in a buccopalatal dimension following loss of the buccal plate may lead to a concavity, creating a shadow with perceivably poor aesthetics.¹¹ This concavity is attributed to loss of the bundle bone and is more pronounced in thin gingival biotype patients, thin buccofacial plates, dehiscences following extraction, or incorrect buccofacial placement of the dental implant.⁹ The net result may be an unacceptable aesthetic outcome that is difficult or impossible to repair.¹² Nonetheless, knowing, understanding, and managing these risks may improve the predictability of successful immediate implant placement in the aesthetic zone. Whilst augmentation may correct a midfacial recession and/or a buccopalatal collapse, soft tissue augmentation of the facial tissues at implant placement may provide tissue bulk regardless of the biotype, and prevent this complication.¹³ Immediate placement positioning within a fresh extraction socket must be modified as opposed to early or delayed protocols to better manage the foreseen changes in tissues that follows healing.⁹, ¹⁴ Additionally, the provisionalization and early loading of implants in the aesthetic zone is recommended.¹² Such a provisional restoration should be anatomically correct with a desirable emergence profile with

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Figures: 1, 2, 3: The preoperative presentation.
respect to the peri-implant soft tissue and supporting alveolar bone, and this may be done with the patient’s own tooth for more natural aesthetics. Correct implant selection, correct placement positioning, grafting techniques, and immediate provisionalization may better ensure a desirable outcome to immediate implant placement. Hereafter is a case presentation of these techniques by Covani, Grunder, Azzi, and Steigman in an attempt to realize these aesthetic aims. A 35 year old healthy male patient presented with a main complaint of a mobile tooth. A history of trauma was unclear. Clinical examination noted an asymptomatic tooth 22 with a Class III mobility and soft tissue inflammation (Figs. 1, 2, 3). A preoperative cone beam computed tomography (CBCT) scan demonstrated significant external resorption of tooth 22 with surrounding bone loss (Fig. 4). Clinical examination and photographs identified a high lip-line with a high aesthetic value (Fig. 5). The tooth was indicated for extraction and the patient’s primary desire was to have the edentulous space rehabilitated with a fixed prosthesis. The ITI SAC Assessment Tool classified the case as complex, with treatment planned for immediate implant placement following extraction of tooth 22, a connective tissue graft of the facial aspect by tunnel technique, and immediate provisionalization with the patient’s own tooth. The aim was to provide a near identical and immediate tooth replacement, as well as to

**Case History**

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maximally support the peri-implant tissues. These would be assessed by radiographic and photographic documentation of the treatment.

Methods and Materials
Preoperative treatment planning demonstrated the restorative outcome via study casts with an anatomical wax-up. This ideal prosthetic representation was translated to the surgical guide (Figs. 6a, 6b). Planning from the CBCT scans mapped the anterior maxillary ridge architecture with its bone volume dimensions. From this information a screw retained prosthesis was planned, and a 4 mm x 11.5 mm tapered and threaded implant was selected (AnyRidge, MegaGen). At day of treatment, tooth 22 was extracted with an as
minimally traumatic technique as possible. The tooth socket retained all its walls intact, verified by probing of the alveolar crests. The implant was then immediately placed into the fresh extraction socket. Covani recommends immediate placement toward the palatal/lingual aspect of the socket and in a deeper position. The implant's ISQ was then measured and recorded (M:80, B:76). A cover screw was secured in place and the buccal gap filled apico-coronally with a xenograft material (OsteoBiol, Tecnoss). Placing a cover screw before this step prevents foreign material lodging in the implant's entry point (Fig. 7). Following Grunder's recommendations, a connective tissue (CT) graft was used to augment the facial soft tissue simultaneous to implant placement. The attached gingiva was lifted as a split thickness tunnel preparation according to Azzi's technique, with release incisions made in the sulcular areas one tooth each side of the extraction site. The CT graft that corresponded to the recipient site was harvested from the ipsilateral palate, drawn into to the tunnel preparation by sutures at its medial and distal portions, secured into place, and bulked the soft tissue facial of the implant site (Fig. 8). With the grafting steps completed, the implant was immediately provisionalized with the patient's own tooth according to Steigman. A template was taken of the maxillary teeth using a polyvinylsiloxane putty prior to extraction. Once the tooth was removed, its root was sectioned off with a hydrated dental bur, the root and pulpal tissues removed, and the remaining crown sectioned leaving the tooth's facial and palatal aspects only. The cut tooth crown surfaces and dentine were then etched for 30 seconds with a 37% phosphoric acid etchant (Scotchbond, 3M), then rinsed and dried (Fig. 9). A layer of dentinal bonding agent

Figures 12a, 12b: Flowable composite is applied into the guide, bonding the patient's crown to the provisional abutment.

Figures 13a, 13b: Provisional abutment is fixed to a laboratory abutment for handling outside the mouth. Composite is added to create the desired morphology and emergence profile.
covered with a layer of composite. Occlusion was checked and adjusted to ensure no contact with the opposing dentition in either occlusal, excursive or protrusive movements. Postoperative photographs documented the immediate post-treatment presentation (Figs. 15a, 15b). Postoperative instructions stipulated the patient avoid the use of and directly chewing with the provisional crown for 6 weeks minimum and no direct brushing in the area for at least 10 days. The patient was recalled for follow up at 1 week, and at 1, 3, and 6 months (Figs. 16a, 16b). Integration was evaluated at 3 months and ISQ was again measured (M-81, B-78) (Fig. 17). Clinical photographs documented the soft tissue profile at the implant site (Figs. 18a, 18b). The implant was restored thereafter with a final screw-retained zirconium crown (Figs. 19a, 19b). Radiographs at the 6 month follow-up visit demonstrated excellent bone growth. The radiographs showed to what extent bone had grown toward the implant, and even onto and over the neck of the implant, illustrating how the morse taper connection maintains the bone and encourages its growth (Figs. 20a, 20b, 20c). Viz the peri-implant and facial tissues were positively supported (Figs. 21a, 21b, 21c). With the before and after incisal views digitally superimposed, the near identical facial tissue profile can be noted – central incisor and canine coinciding in the superimposed images with the implant restoration positioned slightly palatal (Fig. 22).

Discussion
Meticulous planning is paramount in implant dentistry. Preemptively positioning the proposed implant is a prerequisite to avoiding incorrect angulation, injury and...
Removal of the tooth without intervention results in greater tissue collapse, resorption, remodeling, and a possible tissue deficit. In delayed implant placement timing, soft tissue augmentation or guided bone regeneration may be required to correct this. Alternatively, immediate implant placement into a fresh extraction socket in the aesthetic zone coupled with grafting of the facial tissues with immediate provisionalization may reduce and prevent this tissue loss. Immediate placement must ensure the implant table is distanced ≥2 mm from the socket’s facial perimeter. Placement should be deeper within the socket, and orientated more lingual/palatal so as to ensure a ‘safety zone’ of bone healing with resorption whilst ensuring coverage of the implant. Grafting of the buccal gap better counteracts this resorption from the facial. Implant selection is key. As demonstrated in this case, an internal connection morse taper implant with a built-in platform switch is superior in that it reduces the amount of abutment complication at sites with anatomical limitations. The buccofacial plate thicknesses at maxillary anterior teeth are approximately 0.97 ± 0.18 mm (central incisors), 0.78 ± 0.21 mm (lateral incisors), and 0.95 ± 0.35 mm (canines) respectively.

Figure 16a: 1 week follow up.

Figure 16b: 1 Month follow up.

Figure 17: ISQ evaluation at 3 months.

Figures 18a, 18b: Soft tissue presentation at 3 months of provisionalization with the patient’s own tooth.
inflammatory cell infiltrate exposure to the crestal bone. A Morse taper connection also provides the best abutment stability and the lowest von Mises stress concentration in the abutment screw. Not only is resorption of the crestal bone minimized, it can grow toward and onto the implant, as seen with this case. This critically contributes to the soft tissue stability, support of interdental papillae, and a positive aesthetic outcome of the rehabilitation over the long-term. Tarnow states that for a 98% papilla fill the distance from contact point to alveolar crest must be ≤ 5 mm. This case could possibly have ensured better papilla fill were the mesial contact of the provisional sculpted further apical with a direct restorative material. Whilst the implant can be provisionalized with a prefabricated pontic, or chairside entirely out of direct restorative materials, this case demonstrates the use of the patient’s own tooth to create a ‘walk out as you walk in’ provisional restoration. This saves time and reduces site contamination by repeated material additions and adjustments and insertions of the provisional. When using the patient’s own tooth crown and positioning it via a putty guide, a provisional as true to life as possible can be provided to the patient immediately at day of tooth extraction. By carrying out a tunnel technique with a connective tissue graft, the facial tissues can further be reinforced to maintain ideal aesthetics. The tunnel technique is a split thickness approach obviating the stripping of periosteum, ensuring vital vascularization to the underlying bone, further preventing unnecessary resorption. The connective tissue benefits from being an autograft and bulks the facial soft tissue. While the buccal gap has been proposed by some authors as able to heal adequately by blood-fill alone, an osteogenic and resilient graft material for filling the buccal space may be superior. An immediately placed provisional restoration with a desirable emergence profile circumferentially

Figures 19a, 19b: Final implant crown at day of delivery. Soft tissue symmetry between both lateral incisors is maintained.

Figure 20: (a) Radiograph at day of implant placement; (b) At 4 months follow up with final restoration, (c) At 6 months follow up. Note chronologically the development of the bone, to eventually grow over the implant table.
supports coronal tissues and prevents their collapse.26 Ensuring pontic to tooth contact at the appropriate heights will further ensure papillae preservation.23

Conclusion
Meticulous restorative treatment planning of a tooth destined for extraction is essential. Selecting the appropriate implant and techniques may preserve and ensure natural aesthetics. Utilizing the patient’s own tooth crown can better provisionalize the implant with a ‘walk out as you walk in’ result.

Declaration
No conflicts of interest are declared.
References


