CASE LETTER

A Combined Approach for the Treatment of Resorbed Fresh Sockets Allowing Immediate Implant Restoration: A 2-Year Follow-Up

Rafael Scaf de Molon, MSc1*
Erica Dorigatti de Avila, PhD2
Joni Augusto Cirelli, PhD3
Francisco de Assis Mollo Jr, PhD2
Marcelo Ferrarezi de Andrade, PhD3
Luiz Antonio Borelli Barros Filho, DDS4
Luiz Antonio Borelli Barros, PhD5

INTRODUCTION

Demand has increased for predictable long-term esthetic results with immediate placement and loading of dental implants. Clinicians are able to meet these demands because of improvements in techniques and biomaterials. Therefore, the indication for immediate implant placement and loading, even in the esthetic regions, has expanded.1,2 When a tooth is extracted, loss of bone height (3.8 mm) and width (1.4 mm) occur in the first 6 months and continues thereafter at a rate of 0.25%–0.5% per year.3 To maintain the gingival architecture and achieve the optimal esthetic result, atraumatic extraction and immediate implant placement are essential. Due to alveolar bone loss4 and gingival recession5 found with compromised periodontal teeth, the pretreatment anatomy is rarely ideal, and therefore compromises the interdental papilla and buccal gingival tissue of the final prosthesis. These factors—with the additional complications of mobility, clinical attachment loss, and systemic diseases (ie, diabetes mellitus6)—make the achievement of optimal esthetics, function, and hygiene maintenance particularly difficult.

Dental implants placed immediately after tooth extraction and immediate loading have several advantages compared to delayed implant placement and conventional loading. These advantages include: (1) a reduction of bone resorption, (2) an immediate esthetically acceptable restoration, (3) shorter treatment time, (4) increased patient acceptance, (5) quicker return of function, (6) potentially superior soft tissue profile, (7) avoidance of a removable prosthesis, and (8) reduced surgical trauma.7–10 Likewise, there are also disadvantages with immediate implants mainly related to the long-term clinical results. Disadvantages include: (1) stability of the buccal osseous and soft tissues, (2) unpredictable site morphology, (3) a limited amount of soft tissue, and (4) a residual bone defect between the implant and the bone wall.11–14

To solve these disadvantages and make this protocol more predictable, we propose a single-appointment–combined approach for the treatment of a periodontally compromised tooth that involves: (1) atraumatic tooth extraction, (2) immediate implant placement, (3) autogenous block and particulate bone graft, (4) connective tissue graft, and (5) immediate restoration without incision. To the best of our knowledge, there are few reports that describe this combined surgical technique for the treatment of a hopeless tooth in the esthetic region.

CASE REPORT

A 27-year-old Caucasian woman was referred to the Department of Periodontology for the treatment of her maxillary right first premolar. The patient’s chief complaint was tooth mobility and esthetic appearance (Figure 1a). She had no relevant medical history and denied smoking or the use of alcohol. Her dental history revealed a maxillary right first premolar that had been treated with root canal therapy and been restored with a metal-ceramic crown. Periapical radiographs demonstrated unsatisfactory endodontic treatment and localized vertical bone resorption on the mesial (Figure 1b). Periodontal examination revealed thick gingival tissue and localized gingival recessions. Probing depths ranged from 3–4 mm but in her right maxillary premolar a localized 7 mm of probing depth was detected next to the right canine with signs of class II tooth mobility, absence of keratinized gingiva, and 2 mm of gingival recession. Based on clinical and radiographic examinations, an immediate implant placement followed by regen-
ervative procedures and immediate provisionalization of the crown was proposed and accepted by the patient. Written informed consent was obtained prior to treatment.

Initially, a basic periodontal treatment was performed involving oral hygiene instructions and reinforcement of her hygiene efforts followed by supra and subgingival scaling and root planning. After two weeks, the maxillary right first premolar was atraumatically extracted under local anesthesia (Mepivacaine 2% and Epinephrine 1:100 000, Mepiadre, DFL, Rio de Janeiro, RJ, Brazil) with a flapless technique using a periotome (Nobel Biocare, Yorba Linda, Calif) to preserve the buccal bone architectures and the osseous structures around the fresh socket (Figure 1c and d). After the tooth extraction, the alveolus was curetted and a narrow dental implant (3.5 × 13 mm Cone Morse Drive, Neodent, Curitiba – PR, Brazil) was immediately inserted (Figure 2a through d), respecting the minimum distances necessary to establish optimal esthetic results and achieve the appropriate emergence profile: in the mesiodistal direction, at least 2 mm away from the adjacent teeth, the implant shoulder placed 3 mm apical to the cement-enamel junction of the adjacent right maxillary canine, and the axis of the implant was with the incisal edges of the adjacent teeth or slightly palatal. The initial stability of the implant was 40 Ncm, allowing immediate provisionalization of the crown.

Because the buccal bone plate was lost due to the inflammatory process, autogenous bone block graft removed from the maxillary tuberosity was used to increase both the horizontal and vertical dimensions of the alveolar socket. To obtain the bone graft from the maxillary tuberosity, the procedure was performed under local anesthesia (Mepivacaine 2% and Epinephrine 1:100 000, Mepiadre 89, DFL). To harvest the maxillary bone, an access preparation was carried out with a crestal and two vertical releasing incisions in the posterior area adjacent to the maxillary left first molar (Figure 3a). A mucoperiosteal flap was then obtained (Figure 3b), the osteotomy performed with rotating instruments, and a thin block of bone was obtained with mallet and chisel (Quinelato, Rio Claro, SP, Brazil) (Figure 3c and d). After a provisional titanium cylinder was connected to the implant neck (Figure 4a and b), the bone graft was immediately placed into the alveolar socket above the implant (Figure 4c and d). To fill the bone-to-implant gap, the block bone graft removed from the maxillary tuberosity was ground into a particulate consistency using a bone mill (Neodent) and was inserted after releasing a sulcular incision (Figure 5a through d). The mucoperiosteal flap was

![Figures 1 and 2. Figure 1. (a) Initial clinical aspect of the maxillary right first premolar. (b) Periapical radiograph showing advanced vertical bone loss, endodontic treatment, and a metal ceramic crown. (c and d) Atraumatic extraction of a hopeless tooth to preserve the osseous contour. Figure 2. (a–d) Immediate implant placement in an ideal tridimensional position to achieve the appropriate emergence profile: in the mesiodistal direction, at least 2 mm of the adjacent teeth and the implant shoulder placed 3 mm apical to the cement-enamel junction of the adjacent right maxillary canine, and the axis of the implant was with the incisal edges of the adjacent teeth or slightly palatal.](https://example.com/image.png)
repositioned, and the defect was sutured with Vicryl 4-0 thread (Ethicon, Johnson & Johnson SA, Sao Paulo, SP, Brazil).

Due to the thin gingival biotype and a previous gingival recession, an autogenous connective tissue graft was removed from the palate, as previously described, under local anesthesia (Mepivacaine 2% and Epinephrine 1:100 000, Mepiadre, DFL) and inserted above the block bone graft to improve the width and thickness of keratinized gingiva (Figure 6a and b). A simple suture with Nylon 5-0 thread (Ethicon, Johnson & Johnson) was made to avoid the connective tissue graft movement. Finally, a provisional resin crown was placed over a provisional titanium cylinder (Figure 6c and d). The patient was seen 1 week after surgery for suture removal and for provisional resin crown adjustments. Postoperative visits included oral hygiene instructions and plaque control every month for 4 months after surgery.

After 4 months postoperatively, an improvement of the gingival margin width and thickness was observed (Figure 7a). The provisional restoration was removed (Figure 7b), and the prosthetic procedures were initiated by transfer impression for coping fabrication (Figure 7c and d). The implant-prosthetic connection was platform switch, displacing the implant-abutment interface and the microgap away from the edge of the implant and minimizing the micro-leakage. The choice for the platform switch was based on previous work that had shown less marginal bone loss compared to the platform-matched implants. A zirconia custom abutment was made using CAD/CAM technology to create an esthetic contour at the gingival margin (Figure 8a through d). Then, feldspathic porcelain crown IPS Empress II – lithium-disilicate glass-ceramic restoration (Ivoclar, Vivadent) was fabricated and cemented over the abutment to achieve an excellent esthetic results (Figure 9a through d).

The 2-years of follow-up results have demonstrated an improved width and thickness of gingival architecture, therefore allowing an optimal esthetic outcome without gingival recession or probing depths. Additionally, there was no bleeding upon probing. Periapical radiographs showed the correct position of the implant in relation to the adjacent teeth and the increased vertical bone formation completely filling the osseous vertical defect without marginal bone loss. The functional and esthetic expectations of the patient were achieved (Figure 10a and b) relative to the pretreatment situation (Figure 10c and d).

**DISCUSSION**

Treatment of periodontally compromised tooth with immediate implant placement in the fresh extraction socket in the esthetic
region is a complex clinical challenge. This is especially true when a tooth involves advanced alveolar bone loss and gingival recession. Treatment demands a multidisciplinary approach, proper diagnosis, and a precise treatment plan to achieve optimal esthetics results.17

In the present case, the treatment option began with the atraumatic extraction of a hopeless tooth. This approach is justified because the ridge preservation maintained the existing soft and hard tissue for optimizing esthetic and functional outcomes.3 The implant was then placed immediately to prevent bone resorption that usually occurs after a tooth extraction. The bone resorption could result in portions of the implant becoming exposed, leading to poor esthetic results.10 Adequate implant length selection to engage enough bone for initial stability and primary integration was achieved with a 15 mm-diameter implant. A minimum of 5 mm of vertical bone-to-implant contact was obtained to provide adequate primary stability that allowed for the immediate prosthetic provisionalization of the implant.18

In this case, we chose to use a narrow-diameter implant (NDI) due to the limited buccolingual width alveolar bone, which could impair the bone healing after the autogenous bone graft placement. In addition, a standard-diameter implant (SDI) could increase the risk of a dehiscence defect. In a recent paper, Arisan et al19 evaluated the survival rates of 316 NDI (diameter < 3.75 mm) inserted into 139 patients and restored them with 120 prostheses followed over a 10-year period. The results showed a successful implant rate and survival rate of 91.4% and 92.3%, respectively, indicating that NDI could be used with safety and predictability when an SDI is not appropriate. These findings are in agreement with another retrospective study20 that evaluated 510 NDI in 237 patients followed for a median of 20 months. The authors revealed an implant survival rate of 99.4% for NDI, similar to SDI.21–23 Comparable results were found in a recent paper using 17 NDI immediately provisionalized in 13 patients, showing 100% success rate after 12 months.24 Our results after 2 years of follow-up showed stability of the gingival margin and absence of marginal bone loss and bone dehiscence when a NDI with 15 mm length was immediately placed after tooth extraction, followed by regenerative procedures and immediate provision-alization of the implant. These successful results could be explained due to NDI providing enough space in the fresh extraction socket to place the block bone graft without overtensioning the buccogingival tissue, thus allowing the maintenance of the source of blood supply to the bone and connective tissue graft, which is essential to ensuring long-term implant success. Furthermore, the reduction of drilling steps...
needed for the installation of NDI compared to SDI was favorable to the healing process.\textsuperscript{25} According to Covani et al\textsuperscript{26} the use of NDI in relation to the extraction socket width plays an important role in reducing the rate of vertical bone resorption at the buccal aspect of implants placed in fresh extraction sockets.

Considerable attention has been given to determine the remodeling of the alveolar ridge that occurs after tooth extraction and implant placement. In a clinical study, Covani et al\textsuperscript{27} evaluated the bone healing following immediate or delayed (6–8 wk) implant placement after tooth extraction. The result of this study showed marked reduction of the alveolar bone width 4–6 months after implant placement, independently of the timing of implant installation. In contrast, Araujo et al\textsuperscript{14} investigated the alterations that occurred during the healing process following premolar and molar tooth extraction and immediate implant installation in dogs. The results showed that implant placement failed to preserve the alveolar bone ridge dimension after tooth extraction. These results can be attributed due to the marginal gap between the implant and the socket bone walls, which is larger in the molar area, resulting in greater width and depth alveolar bone defect. The same research group evaluated whether established osseointegration following implant placement after tooth extraction could be lost due to tissue remodeling.\textsuperscript{13} The authors observed that the marginal gap between the implant and the bone wall was filled with a coagulum, which was replaced by newly formed bone after 4 weeks. However, after this interval, bone-to-implant contact, at least in part, was lost during the healing process, which is in agreement with another study.\textsuperscript{28} Due to these observations, we chose to combine the autogenous block and particulate bone graft, followed by connective tissue graft. This was done to avoid bone resorption that normally occurs during the initial phase of healing that follows immediate implant placement in alveolar fresh sockets.

The usual instability in the long-term esthetic results as an effect of traditional immediate implants is placed at a critical point in this protocol. Several clinical studies have demonstrated that about 20%–30% of immediate implants resulted in gingival recession of 1 mm or more, justified by the lack of buccal plate, gingival recession, or poor implant positioning.\textsuperscript{29–31} For these reasons, an autogenous bone graft obtained from the maxillary tuberosity was placed in the fresh socket without incision on the receptor site to improve the facial osseous contour and provide sufficient height and thickness of support for the soft tissues. Thereafter, a particulate bone graft was added to fill the gap between the bone-to-implant contact because previous studies have shown that bone gap distances greater than 0.5 mm result in unpredictable bone deposition on the implant surface.\textsuperscript{32} In addition, a connective tissue graft was
placed in the fresh socket to obtain a harmonious esthetic restoration. The combination of the bone graft and connective tissue graft played an important role in compensating the alveolar bone changes that normally follow during the healing process.12,29–31,33

To evaluate the stability of the peri-implant tissues around implants placed immediately after tooth extraction with simultaneous increase in tissue volume by means of guided bone regeneration using bioabsorbable collagen membrane, autogenous bone and deproteinized bovine bone, a prospective study by Buser et al34 demonstrated stability of hard and soft tissues of all 41 implants examined, without compromising the peri-implant esthetic in the anterior maxilla. A 5- to 9-year follow-up confirmed that the risk for gingival recession is lower when the implant is placed immediately after tooth extraction. The concept of immediate implant placement after tooth extraction with the simultaneous bone augmentation procedure resulted in a positive esthetic outcomes.

In conclusion, this treatment protocol created a harmonious gingival architecture with sufficient width and thickness, maintained the stability of the alveolar bone crest, and thus resulted in an excellent esthetic 2-years of follow-up. This treatment protocol performed with state-of-the-art techniques can predictably and consistently result in successful outcomes.

**ABBREVIATIONS**

NDI: narrow diameter implant
SDI: standard diameter implant

**REFERENCES**

4. de Molon RS, de Avila ED, Nogueira AV, et al. Evaluation of the host