Proposed Treatment Approach for Type II Sockets: Report of Two Cases

Brian J. Jackson, DDS

INTRODUCTION

Healthcare globally is trending toward minimally invasive procedures that deliver better outcomes while meeting patient expectations. Implant dentistry procedures, techniques, and materials coincide with this approach. These results are possible through the synergism of comprehensive treatment planning cone-beam computerized tomography (CBCT) imaging, guided surgery, and newer prosthetic approaches.

In-depth knowledge is necessary to comprehend the response of surgical and prosthetic procedures. Challenges exist in achieving optimal gingival esthetics around single anterior implants in addition to maintaining the results over time.[1] An adequate pre-existing soft-tissue architecture at the intended implant sight and proper adjacent gingival tissue contours are essential for a positive outcome.[2] Clinical research reveals high success rates when a period of stress-free undisturbed healing is permitted.[3] There is also less bone loss with the immediate placement of implants versus delayed placement. Andersen et al found in some cases of immediate implant placement there was an increase in bone volume.[4]

The immediate implant placement and provisionalization (IIPP) approach includes a single surgery that encompasses tooth extraction, and implant placement with a transmucosal healing collar. This results in the elimination of a second stage uncovering surgery. The IIPP approach also includes the making of a final impression, guided bone regeneration (GBR), and provisionalization at the same appointment as the tooth extraction. Because of the growth factors contained within platelets, some clinicians choose to use platelet concentrates with the GBR procedure.

The final restoration is placed after osseointegration is complete.[5] When these techniques are performed, research has demonstrated a higher success rates with less bone loss, and a resulting stable soft tissue with less gingival recession.[6,7] These findings are more predictable when there is adequate facial soft tissue and a buccal plate of bone present. A tooth extraction socket is referred to as a Type 2 socket when preoperatively the facial soft tissue is present but there is a partial or completely missing buccal plate of bone over the tooth of interest.

It is documented that the labial bone plate thickness is $\leq$1 mm in 90% of the patients.[8] IIPP aids the patient in selecting implant therapy because it provides for a more efficient treatment time, which can affect a patient's treatment decision for rehabilitation. Patients may choose less than ideal treatment plan based solely on treatment time to completion. IIPP also provides an immediate esthetic restoration in addition to stream lining the overall treatment time.[9] When the surgical and prosthetic procedures are performed at the same appointment, there is also a reduction in the overall number of surgeries, patient visits, complications, and treatment cost. Patients are often satisfied with the provisional crown while the healing process ensues.[10] Patients prefer a "fixed" transitional restoration vs a removable partial denture or "flipper."

This paper presents the management of Type 2 extraction sockets in the esthetic zone as described by Elian et al[11] Two IIPP cases demonstrating the management of dehiscence for the facial plate of bone are presented. At this point in time, published reports of these clinical scenarios is limited.

CASE HISTORY: 1

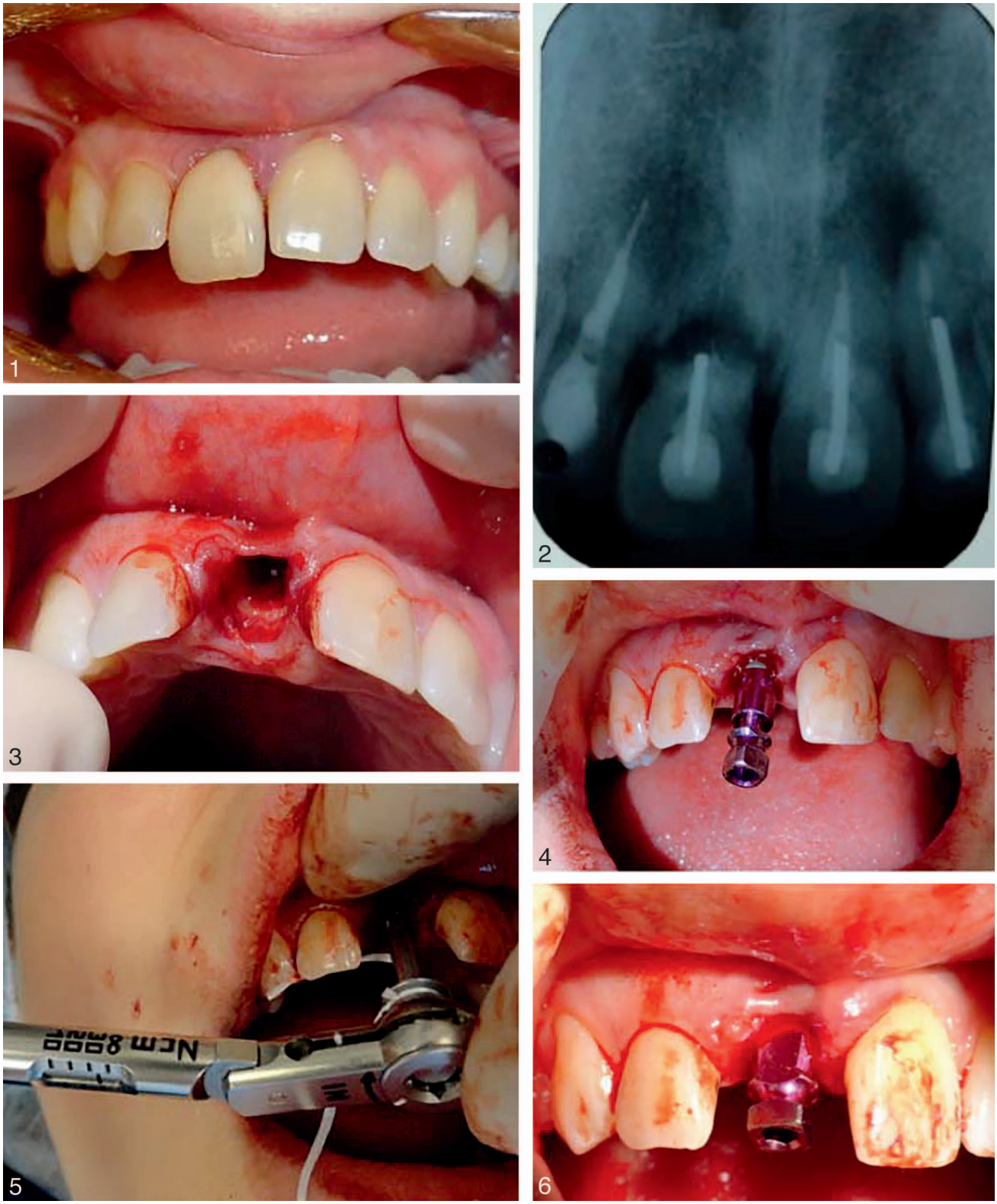
A 36-year-old female patient presented with a mobile maxillary right central incisor. Her chief complaint was "My front tooth had a root canal and is now loose." The clinical and radiographic evaluation exhibited a maxillary right central incisor (#8) with class III mobility and pain (Figure 1). A periapical radiograph revealed an externally resorbed root, severe bone loss and the presence of residual root canal filling material in the bone (Figure 2).

Dehiscence of the buccal plate was confirmed, and a probing depth 6 mm apical from the facial gingival margin was found.

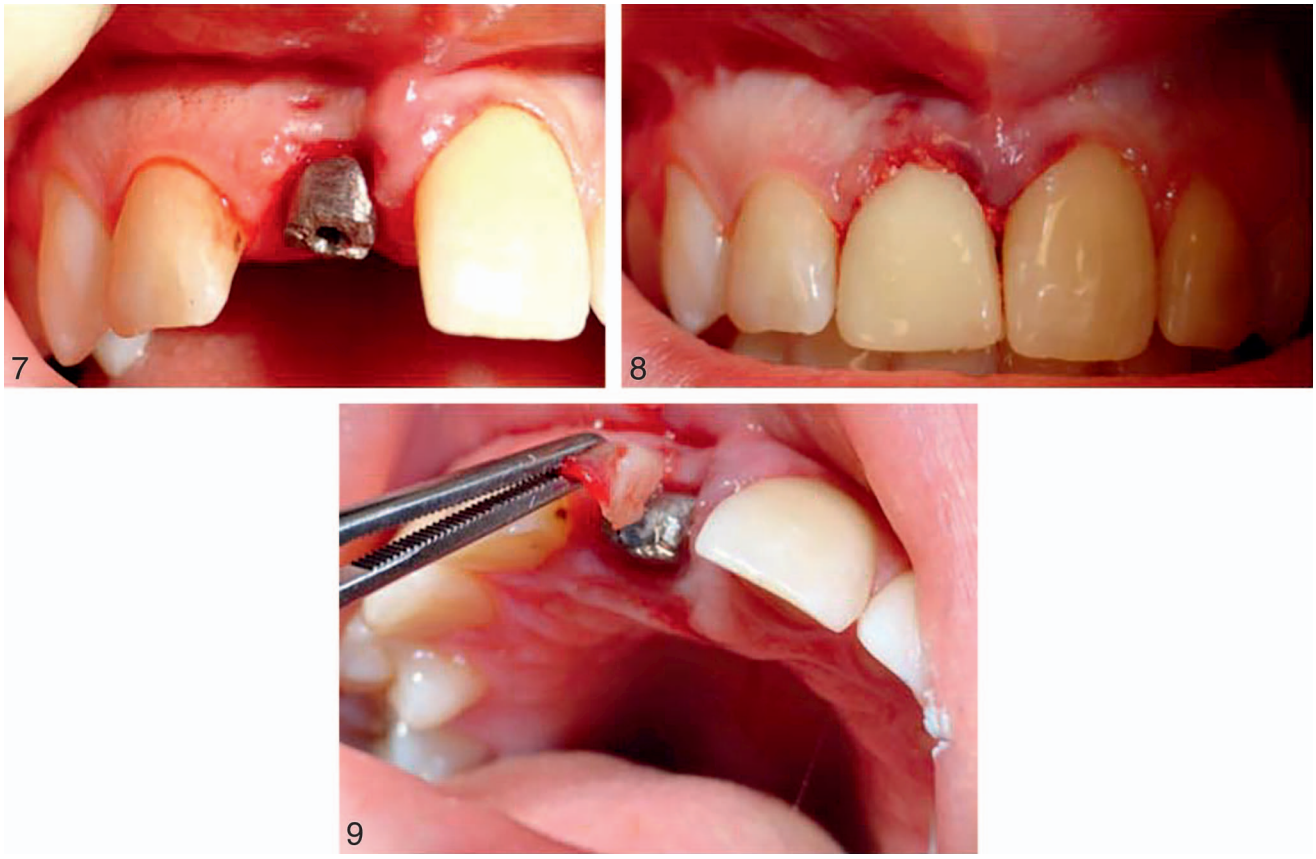
Prior to initiating the surgery to remove tooth #8, a 20 mL whole blood draw via the right median cubital vein was performed. To procure buffy coat platelet rich plasma (BC-PRP), 10 mL of whole blood was drawn into a Becton Dickinson (Franklin Lakes, NJ) yellow top tube containing the anticoagulant trisodium citrate plus dextrose and to procure platelet rich fibrin (PRF), 10 mL into a Becton Dickinson red top tube (silicone coated glass without additives). All tubes of whole blood were placed in a single spin centrifuge and centrifuged at 3100 rpm for 12 minutes. Following the centrifugation process, BC-PRP and PRF were processed.

Local anesthesia (3 carpules, 2% lidocaine [54 mg] with 1:100 000 epinephrine [54 μg]) (Benco Dental Supply, Pittston, Penn) was administered and the tooth extraction was performed with an intrasulcular fibrotomy incision using a 15 c blade. Then 301 and 34 s elevators in combination with a universal forcep were used to remove tooth #8 (Figure 3). A 4.7 $\times$ 13 mm SBM tapered Legacy 1 (Implant Direct, Carlsbad, Calif) implant was inserted with a straight driver 1 mm coronal to final position (Figure 4). Torque was confirmed at a value $>$35

Corresponding author, e-mail: bjjddsimplant@aol.com
https://doi.org/10.1563/aaid-joi-D-18-00148



Figures 1–6. Figure 1. Mobile, right central incisor. **Figure 2.** Periapical radiograph, maxillary right central incisor. **Figure 3.** Tooth socket. **Figure 4.** Fixture mount (4.7 × 13 mm). **Figure 5.** Calibrated torque wrench. **Figure 6.** Impression transfer pin.



Figures 7–9. Figure 7. Temporary titanium abutment. **Figure 8.** Provisional/crown **Figure 9.** Platelet rich fibrin.

Ncm (Figure 5). The final placement of the implant was 4 mm apical to the ideal facial gingival margin.

A fixture level impression with polyvinyl siloxane material (Imprint III, 3M, St Paul, Minn) was taken with a 4.7 mm transfer pin in place (Figure 6). Following the impression, the impression transfer pin was removed. A temporary titanium abutment was prepared, retaining screw placed and torqued to 20 Ncm. A provisional acrylic restoration was then fabricated (Figure 7). The incisal edge of the provisional crown was left minimally short of the ideal desired length to avoid contact in centric occlusion, protrusive, and right or left lateral excursions (Figure 8).

A resorbable collagen type I bovine barrier (cytoplast RTM, Implant Direct) and a PRF bioactive membrane was positioned in the buccal aspect of the residual socket (Figure 9). The remaining "gap" space was grafted with a mixture of BC-PRP and mineralized irradiated bone allograph (Direct Gem-ID, Implant Direct). The bone graft material is a cortical-cancellous mixture with a particulate size of 250–1,000 microns. The provisional crown was placed with temporary cement (Temp-bond, Kerr Corporation, Romulus, Mich).

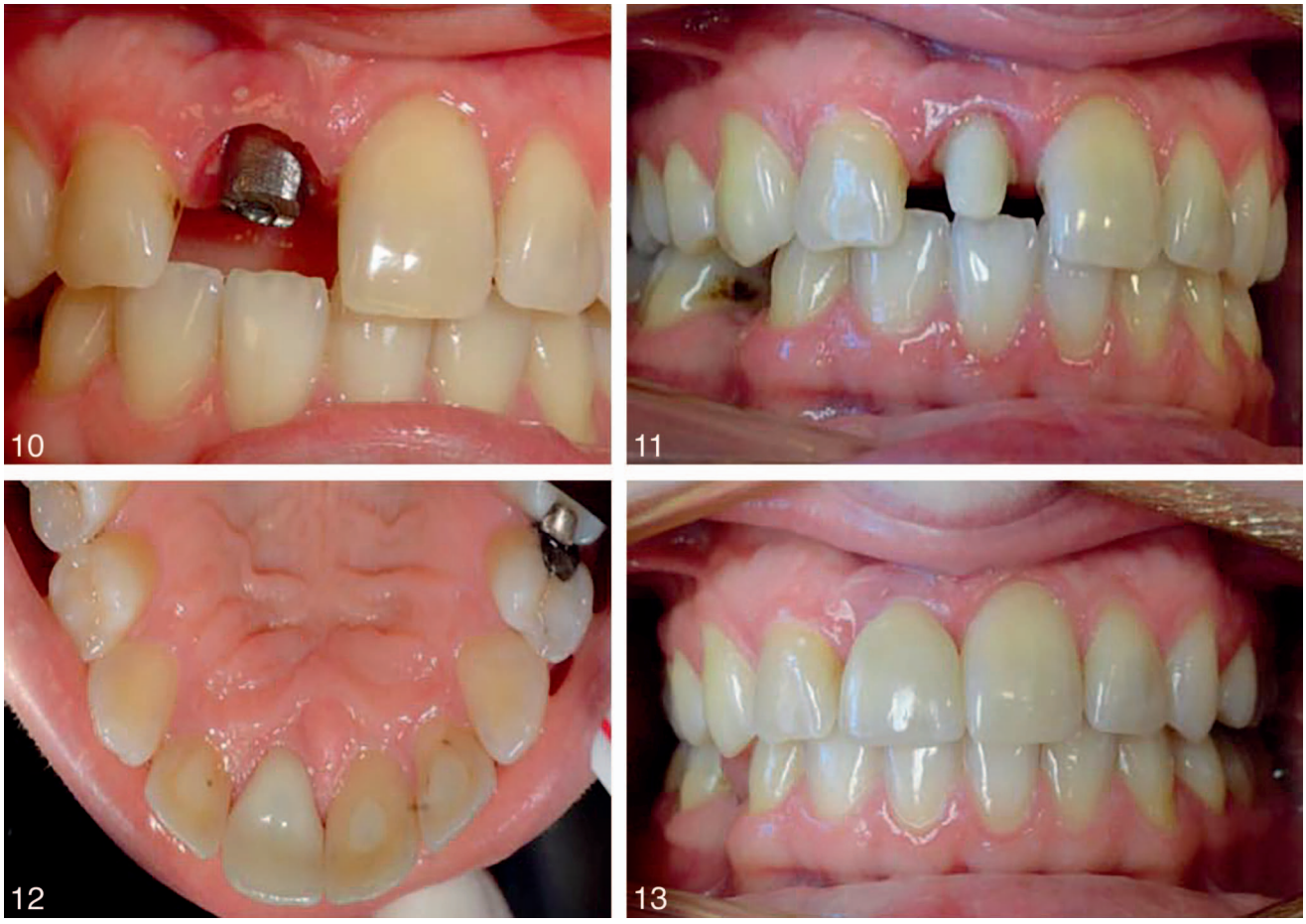
After 3 months, the temporary crown and abutment were removed (Figure 10). A customized zirconia abutment was placed, a periapical radiograph taken to confirm proper seating, and the abutment screw torqued to 30 Ncm × 2 at 5-minute time intervals (Figure 11). The definitive all-ceramic crown (EMAX Ivoclar, Amherst, NY) was placed, using an adhesive resin cement (Relyx, 3M, St Paul, Minn) (Figures 12 and 13).

Case History: 2

A 71-year-old male presented for evaluation of a loose maxillary left lateral incisor (tooth #10). The patient's chief complaint was "My front tooth has been loose for 4 years but it is now very loose." The clinical evaluation consisted of a medical history, clinical exam, CBCT, diagnostic models, and photographs (Figure 14). The tooth demonstrated class III mobility with a chronic fistula. The radiograph demonstrated root perforation and associated interproximal bone loss. The CBCT exhibited a dehiscence of the facial plate of bone (Figures 15 and 16).

BC-PRP and PRF were obtained as already mentioned in Case #1. Local anesthesia (2 carpules, 2% lidocaine [36 mg], with 1:100 000 epinephrine [36 μg] [Benco Dental Supply]) was administered, then the maxillary left lateral incisor (#10) was extracted in an atraumatic flapless manner (Figure 17). The buccal plate of bone was evaluated with a periodontal probe. A 3.7 × 13 mm SBM tapered Legacy 1 (Implant Direct) implant was placed with a fixture mount/2.5 m hex tool and a straight driver (Figure 18). A calibrated torque wrench set at 35 Ncm was used to torque the implant to place; however, a resistance torque was not noted.

A 3.7 mm transfer pin was placed, radiograph and a polyvinylsiloxane impression (Implant III, 3M) was taken. A 3.7 × 5 mm healing collar was placed (Figure 19). Following the impression, the impression transfer pin was removed and replaced with a healing collar. A collagen type I bovine barrier (Cytoplast-RTM, Implant Direct) and PRF bioactive membrane



Figures 10–13. Figure 10. Healed site, 4 months. **Figure 11.** Zirconia abutment. **Figure 12.** Final prosthesis, all-ceramic crown (palatal view). **Figure 13.** Final restoration, all-ceramic crown, facial view.

were placed between the buccal mucosa and existing bony walls. Mineralized irradiated bone allograph (Direct Gem, Implant Direct) was mixed with BC-PRP and packed between the barrier, bony walls, and implant surface (Figures 20 and 21). A transitional maxillary removable partial denture that was relieved in the surgical area was inserted (Figure 22).

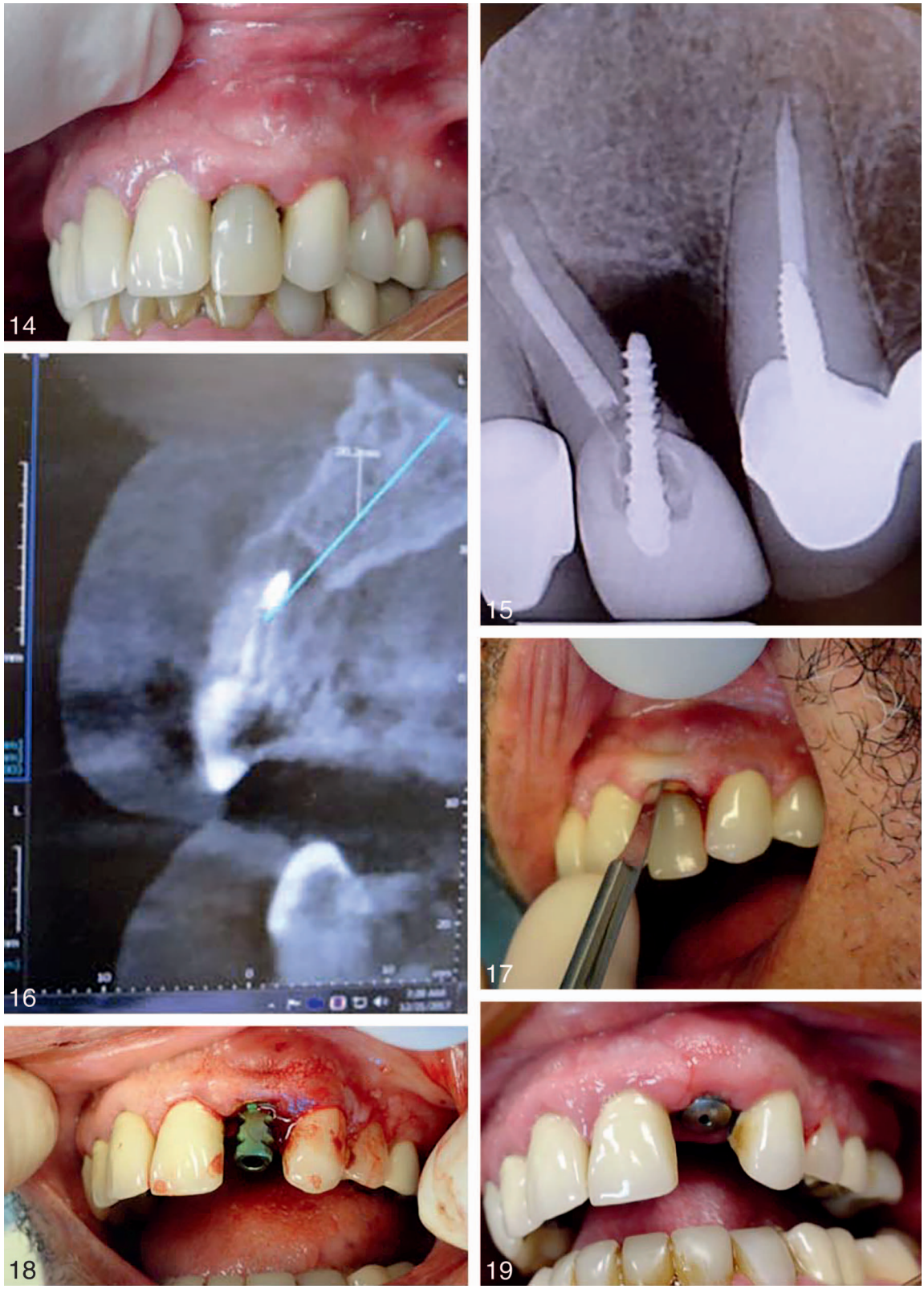
After 3 months, the healing collar was removed. A zirconia abutment was placed, a periapical radiograph was taken to confirm proper placement, and the abutment retaining screw was torqued to 30 Ncm. The definitive porcelain fused metal crown was cemented with permanent cement (Zinc Phosphate Cement—ZOP, Bosworth Company, Skokie, Ill) (Figure 23).

Discussion

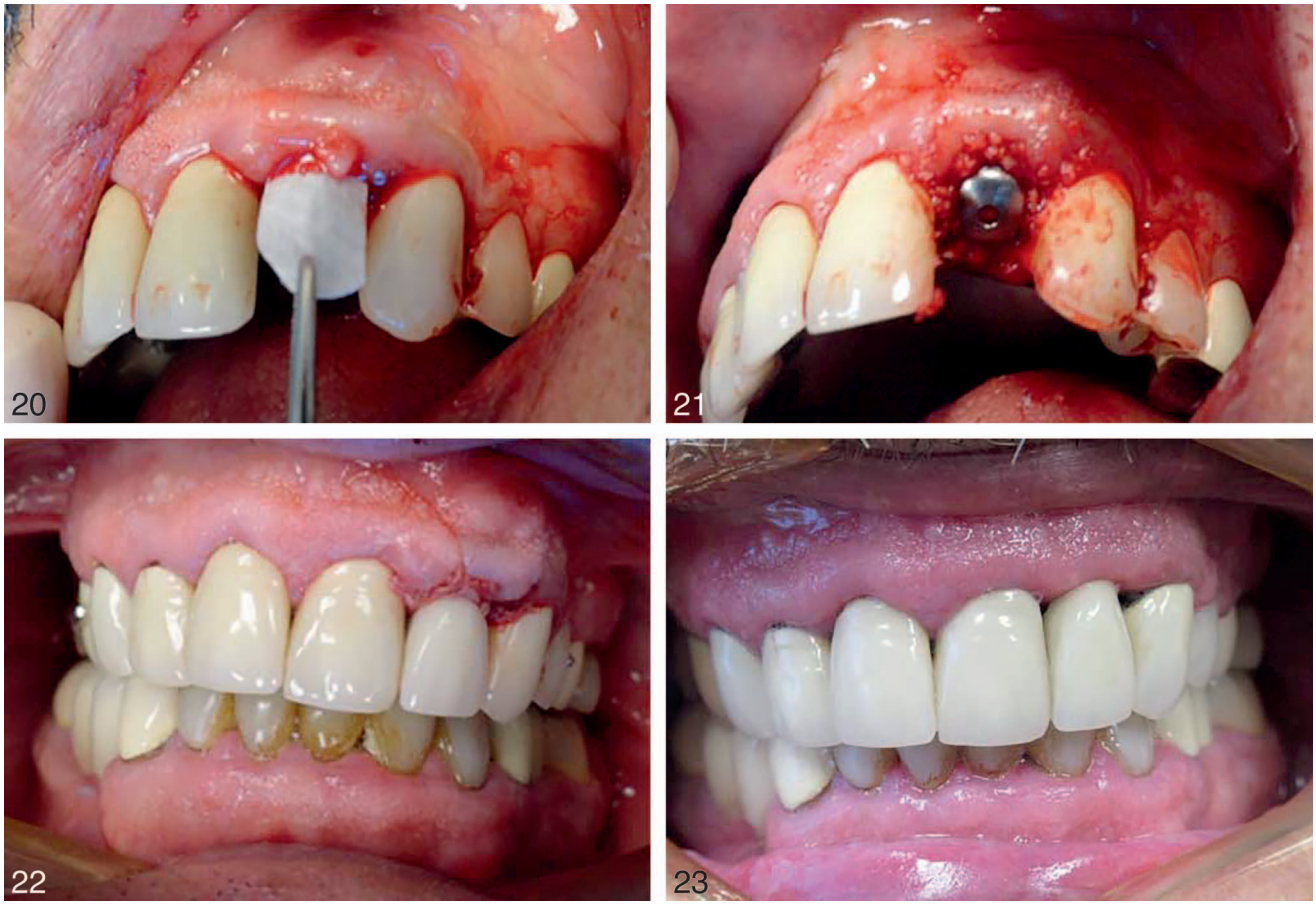
The IIPP approach differs from the conventional 2-stage implant surgical protocol in that the 2-stage technique involves a period of undisturbed bone and soft-tissue healing for 3–6 months prior to implant placement.[12] IIPP protocols differ based on the presence or absence of hard and or soft tissues. Surgical management is more complex when the existing hard and or soft tissues are compromised. When these tissues are compromised, the esthetic outcome is less predictable. Flapless atraumatic extraction principles are key to a successful IIPP procedure. The blood supply to the facial bone plate is mainly derived from the periosteum and elevation of a flap disrupts the blood flow for several days.[13]

Primary stability with a torque resistance of >35 Ncm verifies that an immediate load with provisionalization protocol can be instituted.[14] If this value is not achieved, then a healing collar and removable partial denture is recommended instead of immediate abutment and provisional crown placement. The lack of an adequate torque is the reason that the second case presented received a healing collar and partial denture instead of an immediate abutment and provisional crown. Soft tissue recession is greater when a healing collar is used versus a provisional abutment and restoration.[15] The placement of provisional crown seals the socket, protects the blood clot, and supports the labial gingival margin and interdental papilla.[16] The provisional abutment/crown aids in preserving the existing osseous and gingival tissues.[17] The presence of the provisional restoration provides an immediate mechanical support to the papillae, midfacial gingival tissues, and gingival embrasures. It also provides comfort for the patient and allows for esthetic temporary restoration.[18] A flat concave provisional at the facial gingival margin is ideal.

Platelet concentrations found in BC-PRP and PRF have been shown to accelerate tissue healing. A single platelet contains



Figures 14–19. Figure 14. Initial left view lateral view. **Figure 15.** Periapical radiograph maxillary left incisor #10. **Figure 16.** Cone beam computerized tomography image, sagittal, l view. **Figure 17.** Intrasulcular incision, 15c blade. **Figure 18.** Fixture mount, 3.7 × 13 mm. **Figure 19.** Healing collar, 3.7 × 5 mm.



Figures 20–23. Figure 20. Resorbable collagen barrier. **Figure 21.** Allograph and platelet-rich plasma and platelet-rich fibrin. **Figure 22.** Provisional crown. **Figure 23.** Final prosthesis, porcelain fused metal crown facial view.

greater than 1,000 different growth factors including platelet-derived growth factors, transferring growth factors beta-1 and -2 and insulin like derived growth factor. Growth factors exhibit an active role in recruitment, mitotic activity, and differentiation of soft and hard tissue producing cells. BC-PRP and PRF are active in early wound protection aiding in protection of the dental implant and bone graft materials while demonstrating a reduction in infection rates.[19] PRF contains growth factors within a glycoprotein call matrix increasing its sustainability and growth factor healing abilities by creating hemostasis through the migration of fibroblasts and endothelial cells into the surgical site. The PRF clot matrix contains cytokines and growth factors that are released into the surgical site; allowing a slow release of the growth factors over a 7–10-day period. The use of growth factors has been shown to reduce postoperative pain and infection and can be obtained in a time- and cost-efficient manner.[20]

Type 2 socket classifications is defined as a 2- to 3-wall defect comprising of normal facial soft tissue with a partially or completely missing buccal plate of bone. Management of a type 2 extraction socket with respect to IIPP is based upon the principles of site preservation.[21] Studies have demonstrated that placement of a resorbable barrier within the facial aspect of a socket facilitates bone regeneration.[22] Additional studies have exhibited bone regeneration within a 6-month period when using autogenous bone in conjunction with a flapless approach.[23]

Some clinicians advocate the use of autogenous bone harvested from the maxillary tuberosity which beneficially contain osteoprogenitor cells, and growth factors; however, limited bone quantity and surgical access can demonstrate limitations.[24] The "ice-cream cone" technique to regenerate a type 2 socket with a xenograph and collagen barrier has demonstrated a net gain of 1.32 mm in bone volume.[25] A subsequent study incorporated immediate implant placement, xenograph, and a provisional restoration that resulted in a reduction of 1 mm in labial plate thickness over 6 months.[26] However, when autogenous bone grafting was used there was a 100% survival rate of the graft with no change in the critical midfacial bone height.[27] The Sarnaciaro et al[28] study demonstrated an average graft negative bone remodeling thickness of 0.69 mm after 9 months. Evaluation of apical bone demonstrated no change over the same time period. This was attributed to the flapless approach and presence of an adequate osseous facial bone plate preoperatively.[28] The study evaluated the facial plate of bone pre-extraction and postimplant placement at 9 months. There was a net gain of 2 mm of the facial plate of bone. There had been a complete reconstruction of the facial plate. The critical factors as descried for bone regeneration were flapless extraction technique,

immediate implant placement, immediate custom healing abutment placement, and use of an allograph with a resorbable collagen barrier.

Studies have demonstrated that graft materials placed coronal to the abutment Implant connection is beneficial in increasing soft tissue thickness. Furthermore, it reduces the need for additional future soft tissue grafting procedures.[29] It is in this author's opinion to graft the gap and coronal to the abutment fixture connection and allow for healing by secondary intention.

Studies state that all implant materials induce an overall color change in the mucosa; Zirconia is masked in 2 mm of mucosa but titanium and gold require a minimal of 3 mm.[30] Titanium abutments exhibit a grayish appearance.[31] Titanium and zirconia abutments are more biocompatible than gold abutments. Zirconia has demonstrated enhanced soft tissue adaption, less color alteration, and recession.[32] The abutment screw is torqued to the manufactured recommendation, which ensures maximum screw adaptation and less loosening under load.[33] Implant occlusal principals are applied to the final restoration consisting of no contact in centric occlusion, excursions, and protrusion. A point contact may exist during maximum occlusal contact. The incisal edge of anterior teeth is shorter in the provisional crown but designed at full contour in the final restoration. It is this author's opinion that zirconium abutments with lithium silicate crowns provide the best long-term esthetic result. It is suggested that bone grafting the "gap," proper implant placement, and under contoured provisional abutment/crowns preserve hard and soft tissues.

Conclusion

The discipline of implant dentistry continues to evolve delivering oral rehabilitation in a predictable manner. IIPP is a minimally invasive approach to facilitate the treatment of a single missing tooth. A dehiscence in the facial plate of bone creates a clinical scenario that requires specific protocols for positive outcomes. This paper describes the IIPP approach based upon known research priniciples. Although the IIPP concept was introduced decades ago, additional scientific research is needed to encourage widespread use.

Abbreviations

CBCT: cone-beam computerized tomography

BC-PRP: buffy coat platelet-rich plasma

GBR: guided bone regeneration

IIPP: immediate implant placement provisionalization

PRF: platelet-rich fibrin

Note

The author has not received financial support in content development or implant materials in the preparation of this manuscript.

References

1. Kan JY, Rungcharassaeng K, Lozzada J. Immediate placement and provisionalization of maxillary anterior single implant: 1 year prospective study. *Int J Oral Maxillofac Implants*. 2003;18:31–39.

2. Funato A, Salama MA, Ishikawa T, et al. Timing, positioning, and sequential staging in esthetic implant therapy: a four-dimensional perspective. *Int J Periodontics Restorative Dent*. 2007;27:313–323.

3. Albrektsson T, Branemark P-I, Hansson HA, Lindstrom J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. *Acta Orthop Scand*. 1981;52:155–170.

4. Andersen E, Haanes HR, Knursen BM. Immediate loading of a single-tooth ITI implants in the anterior maxilla: a prospective 5-year pilot study. *Clin Oral Implants Res*. 2002;13:281–287.

5. Jackson BJ. Immediate implant placement and provisionalization: a case report. *NYSAGD*. 2017;12–16.

6. Block MS, Mercante DE, Lirette D, Mohamed W, Ryser M, Castellon P. Prospective evaluation of immediate and delayed provisional single tooth restorations. *J Oral Maxillofac Surg*. 2009;67:89–107.

7. Cooper LF, Raes F, Reside GJ, et al. Comparison of radiographic and clinical outcomes following immediate provisionalization of single-tooth dental implants placed in healed alveolar ridges and extraction sockets. *Int J Oral Maxillofac Implants*. 2010;25:1222–1232.

8. Huynh-Ba G, Pjetursson BE, Sanz M, et al. Analysis of socket bone wall dimensions in the upper maxilla in relation to immediate implant placement. *Clin Oral Implants Res*. 2010;21:37–42.

9. Tortamano P, Camargo LO, Bello-Silva MS, Kanashiro LH. Immediate implant placement and restoration in the esthetic zone: a prospective study with 18 months of follow-up. *Int J Oral Maxillofac Implants*. 2010;25:345–350.

10. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. *Int J Periodontics Restorative Dent*. 2003;23:313–323.

11. Elian N, Cho S, Froum S, Smith R, Tarnow D. A simplified socket classification and repair technique. *Aesthet Dent*. 2007:19:99–104.

12. Branemark PI. Osseointegration and its experimental background. *J Prosthet Dent*. 1983;50:399–410.

13. Cutright DE. The proliferation of blood vessels in gingival wounds. *J Periodontal*. 1969;40:137–141.

14. Javed F, Romanos G. The role of primary stability for successful immediate loading for dental implants. A literature review. *J Dent*. 2010;38: 612–620.

15. Small PN, Tarnow DP. Gingival recession around implants: a 1-year longitudinal prospective study. *Int J Oral Maxillofac Implants*. 2000;15:527–532.

16. Baumgarten H, Fraiman H, Chu S. Esthetics through provisional restoration of implants. *Compendium*. 37;676–678.

17. Touati B. Biologically driven prosthetic options in implant dentistry. *Pract Proced Aesthet Dent*. 2004;16:517–520.

18. Cornelini R, Cangini F, Covani U, Wilson TG Jr. Immediate restoration of implants placed into fresh extraction sockets for single tooth replacement: a prospective clinical study. *Int J Periodontics Restorative Dent*. 2005;25:439–447.

19. Bolukbsi N, Yeniyol S, Tekkesin MS, Altimatmaz K. The use of platelet-rich fibrin in combination with biphasic calcium phosphate in the treatment of bone defects: a histological and histmorphometric study. *Curr Ther Res Clin Exp*. 2013;75:15–21.

20. Rutkowski J, Thomas B, Bering C, et al. An analysis of a rapid, simple and inexpensive technique used to obtain platelet-rich plasma for use in clinical practice. *J Oral Implantol*. 2008;34:25–33.

21. Tarnow D, Chu SJ, Salama MA, et al. Flapless postextraction socket implant placement in the esthetic zone: part 1. The effect of bone grafting and/or provisional restoration on facial-palatal ridge dimensional change- a retrospective cohort study. *Int J Periodontics Restorative Dent*. 2014;34:323–331.

22. Tarnow DP, Chu SJ. Human histologic verification of osseointegration of an immediate implant placed into a fresh extraction socket with excessive gap distance without primary flap closure, graft or membrane: a case report. *Int J Periodontics Restorative Dent*. 2011;31:515–521.

23. da Rosa JCM, de Oliveira Rosa ACP, da Rosa DM, Zardo CM. Immediate dentoalveolar restoration of compromised sockets: a novel technique. *Eur J Esthet Dent*. 2013;8:432–443.

24. Corbella S, Tas Chieri S, Samaranayake L, Tsesis I, Nemcovsky C, Del Fabbro M. Implant treatment choice after extraction of vertically fractured

tooth. A proposal for clinical classification of bone defects bused on a systematic review of literature. *Clin Oral Implants Res*. 2014;25:946–956.

25. Tan-Chu JH-P, Tuminelli FJ, Kurtz KS, Tarnow DP. Analysis of buccolingual dimensional change of the extraction socket using the "ice-cream cone" flapless grafting technique. *Int J Periodontics Restorative Dent*. 2014;34:399–403.

26. Noelkin R, Kunkel M, Wagner W. Immediate implant placement and provisionalization after long axis root fracture and complete loss of the facial bony lamella. *Int J Periodontics Restorative Dent*. 2011;31:175–183.

27. da Rosa JCM, de Oliveira Rosa ACP, Francischone CE, Sotto-Maior BS. Esthetic outcomes and tissue stability of implant placement into compromised sockets following immediate dentoalveolar restoration: results of a prospective case series at 58 months follow-up. *Int J Periodontics Restorative Dent*. 2014;34:199–208.

28. Sarnaciaro GO, Chu S, Sarnaciaro E, Gotta S, Tarnow D. Immediate implant placement into extraction sockets with labial plate dehiscence defects: a clinical case series. *Clin Implant Dent*. 2015;1–9.

29. Chu S, Salama M, Salama H, et al. The dual-zone therapeutic concept of managing immediate implant placement and provisional restoration in anterior extraction sockets. *Compend Contin Educ Dent*. 2012;33:524–532, 534.

30. Jung R, Sailer I, Hammerle C, Attin T, Schmidlin P. In vitro color change of soft tissue caused by restorative materials. *Int J Periodontics Restorative Dent*. 2007;27:251–257.

31. Heydeckle G, Kohal R, Glaser R. Optimal esthetics in single-tooth replacement with the re-implant system: a case report. *Int J Prosthodont*. 1999;12:184–189.

32. Rompen E, Touati B, Van Dooren E. Factors influencing marginal remodeling around implants. *Pract Proced Aesthet Dent*. 2003;15:754–761.

33. Winkler S, Ring K, Ring J, Boberick KG. Implant screw mechanics and the settling effect: overview. *J Oral Implantol*. 2003;29:242–245.