Immediate Implant Placement and Provisionalization: A Case Report

By Brian J. Jackson, DDS

Introduction

The field of oral implantology has become a discipline of dentistry with predictable outcomes in the reconstruction of the partially edentulous patient. Research has demonstrated high success rates with conventional implant therapy, which includes a period of undisturbed stress during healing.[1] The delivery of health care has moved toward a minimally invasive approach to reduce treatment time, pain and cost. Immediate implant placement with provisionalization (IIPP) acts in concert with this approach in that it combines surgical and restorative procedures, decreases the number of appointments and eliminates the need for a transitional removable partial denture prosthesis.

IIPP research demonstrates comparable survival rates to conventional approaches in regards to early and delayed loading protocols.[2,3] The esthetic result is enhanced because recession is reduced with the immediate placement and provisionalization protocol. Provisionalization supports the interdental papilla and supporting soft tissue reducing the degree of tissue alterations. IIPP protocol encompasses an atraumatic extraction, implant placement and a transgingival provisionalization. Guided bone regeneration utilizing various bone grafting materials and platelet rich plasma/fibrin is utilized to enhance the healing process. A final fixture level impression is performed at surgery followed by a temporary abutment and crown. The final abutment/crown is placed after a conventional healing period has been established. The procedure is predictable when a torque value of greater than 35 Newton centimeters is obtained and the buccal plate of bone is present.

Socket classifications have been established with emphasis on the presence of a buccal plate of bone and height of soft tissue.[4] A type I socket exhibits an intact buccal plate and ideal soft tissue contours. A type II socket demonstrates a partial loss of the buccal plate and corresponding loss of soft tissue. A type I socket is ideal for IIPP while a type II socket is considered a negative prognostic factor. The clinical and radiographic evaluation is essential to develop a proper diagnosis and a thought-provoking treatment plan. Bone sounding, periodontal probing, mobility testing and digital palpation assess the health of the existing anatomy. A radiographic evaluation demonstrates interproximal bone height, mesial-distal dimensions and native bone apical to the tooth socket.

The IIPP approach exhibits several clinical advantages including a single flapless surgery, incorporation of growth factors and the initiation of the restorative stage at surgery. The procedure provides ideal esthetics, less pain and lower costs with fewer patient visits. Furthermore, a removable partial denture or "flipper" is eliminated during the osseointegrative period.

The following case was the management of a fractured maxillary left central incisor (#9). A diagnosis of horizontal root fracture without restorability was established. The treatment plan approach was an immediate implant placement and provisionalization with complete rehabilitation of a missing central incisor in two visits with one surgery over a three month period.

Case History

A 50-year-old male patient presented to the office with a tooth fractured at the gingival margin. His chief complaint was, "My front tooth just broke off" (Figure 1). The hopeless tooth was bonded to the residual root with a resin cement and the patient was scheduled for an examination.

A diagnostic evaluation was performed and consisted of a medical history, photographs, diagnostic models, intraoral examination and a periapical radiograph (Figure 2). At consultation, treatment options were presented including a single endosseous implant, fixed partial denture or a removable partial denture. A consent was reviewed, signed and a time for treatment completion given. IIPP was discussed including the advantages, indications and limitations.

Figure 1. Fractured maxillary left central incisor (#9).

Figure 2. Periapical radiograph of maxillary left central incisor (#9).

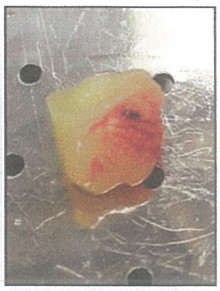

Figure 3. Platelet Rich Fibrin (PRF).

The patient was prepped, draped and asked to rinse with a chlorhexidine mouthwash for 30 seconds. Platelet-rich plasma (PRP) and fibrin (PRF) were developed after a 20mL blood draw from the median cubital vein using a standard phlebotomy technique. PRP preparation was initiated after a 10mL blood draw with a vacutube containing citrate dextrose and PRF was developed after a 10mL blood draw into an empty vacutube (no additive added). The blood was placed in a single spin (Clinseal model, Salvin Dental, Charlotte, NC) centrifuge for 12 minutes for separation of whole blood into platelet rich plasma and platelet rich fibrin (Figure 3). 2% lidocaine with 1:100,000 epinephrine was administered in a buccal and palatal infiltration technique.

An atraumatic extraction of the left maxillary central incisor (#9) was performed with 301, 34s elevators and 151 universal forceps. The residual socket was degranulated with a double-ended curette (Figure 4). The buccal plate, gingival sulcus and socket depth were measured with a periodontal probe and a #9 Schilder endodontic plugger (Figure 5). The osteotomy with a palatal skew was performed with 1.3, 2.3,

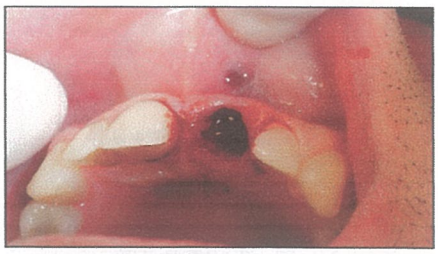

Figure 4. Tooth socket.

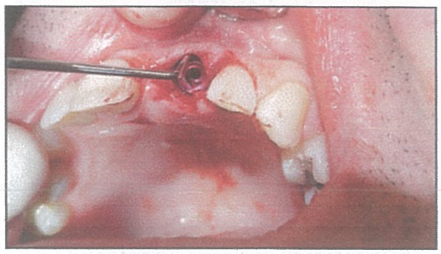

Figure 5. #9 Schilder plugger with rubber stopper.

2.8, 3.4 and 3.8mm drills at 1280 rpm. A 4.7x13mm SBM tapered Legacy 1 (Implant Direct, Carlsbad, CA) implant was manually placed with a straight driver, fixture mount and 2.5mm hex tool (Figure 6).

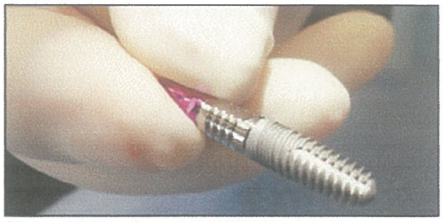

Figure 6. Implant 4.7 x 13mm.

A torque wrench set at 35 Newton centimeters was applied to the implant body 1mm coronal to final placement to evaluate the degree of fixation (Figure 7). A torque value greater than 35 Newton centimeters was achieved and the implant was seated completely.

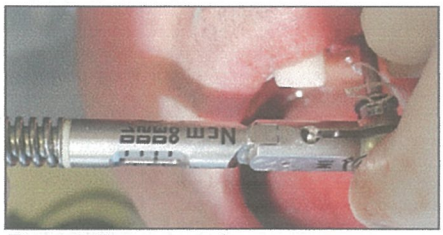

Figure 7. Torque wrench.

A 4.7 transfer pin was screwed into the implant body and a periapical radiograph taken (Figure 8). Orthodontic wax was placed into the screw access hole and a polyvinylsiloxane (Imprint III, 3M, St. Paul, MN) impression taken.

Figure 8. Impression transfer (4.7mm).

A temporary titanium abutment was placed into the implant body and modified in three dimensions to develop interocclusal clearance and crown fabrication. The temporary abutment screw was torqued to 20 Newton centimeters (Figure 9).

An acrylic crown shell with self-curing acrylic was utilized to fabricate the provisional. The buccal gingival aspect of the crown was undercontoured.

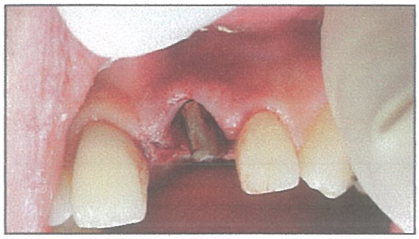

Figure 9. Titanium abutment.

Guided bone regeneration was performed consisting of a mixture of mineralized irradiated bone allograph, PRP and PRF. The mixture was placed in the "gap" located between the socket walls and the implant surface. The grafting mixture was packed and covered coronal to the abutment/implant interface with various size pluggers (Figure 10).

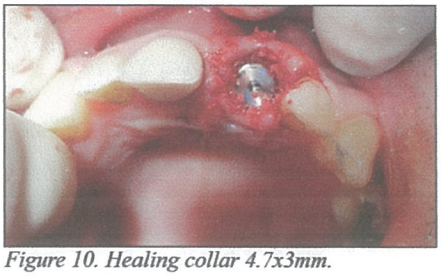

Figure 10. Healing collar 4.7x3mm.

The provisional was cemented with a temporary cement. The occlusion was modified to eliminate all contacts in centric occlusion, protrusion and excursions. The incisal edge was shortened in comparison to the adjacent tooth (Figure 11).

Figure 11. Provisional crown.

A commercial laboratory poured the implant impression and mounted the case. A zirconium abutment was designed and manufactured with a buccal margin placed 1.5mm coronal to the abutment-implant interface. An orientation jig was fabricated to assist in the alignment of the internal hex orientation. An all-ceramic restoration (e.max) (Ivoclar Vivadent, Amherst, NY) was fabricated.

After a three month osseointegration period, the final placement of the abutment/crown procedure was performed. After removal of the temporary crown and abutment, the final zirconium abutment was placed. A periapical radiograph was taken and the abutment screw torqued down to 30 Newton centimeters (Figure 12). The final all-ceramic crown (e.max) was bonded in with a resin bonded material (RelyX) (3M, St. Paul, MN)(Figure 13).

Figure 12. Periapical radiograph of final zirconium abutment.

Figure 13. Final prosthesis: all-ceramic crown.

Discussion

Immediate implant placement and provisionalization (IIPP) is recognized as a minimally invasive approach for replacing a non-restorable tooth. This concept deviates from a delayed approach where a stress-free loading period is observed during a three to six month osseointegration period.[5] Studies have supported the concept of IIPP when comparing histology, survival rates, recession and patient acceptance to early, delayed or staged approaches.[6-8] IIPP research demonstrates high success rates based on stable crestal bone levels while other studies exhibit bone gain.[9-11] Studies exhibit better tissue stability and lower levels of recession around implants restored with a provisional.[12-14] This finding may be in part due to less connections/disconnections of component parts which can impair the mucosal barrier promoting apicalization of the junctional epithelium.[15]

The clinical and diagnostic evaluation is essential when determining if IIPP will produce a successful outcome. Proper diagnosis and understanding of the biological and periodontal variables of the failing dentition and their response to surgical and prosthetic procedures are the essence of predictability.[16] A class I socket classification comprising of an intact buccal plate and ideal soft tissue contour provides for the best anatomical foundation for the execution of IIPP procedures.

The clinical evaluation includes a visual inspection of the gingival margins of adjacent teeth, biotype and smile line. The presence of a high smile line with uneven gingival margins in a thin biotype patient is considered a negative prognostic factor.

Bone sounding is performed to determine the presence and location of the buccal plate of bone. The presence of the buccal plate of bone is an essential parameter for stable soft tissue. Studies have demonstrated that when the buccal plate is located ≤ 3mm from the facial gingival margin then <1mm recession occurs within the first year.[17] A radiographic evaluation of the surgical site provides clinical insight prior to

implant placement procedures. The main objective in surgery is to obtain rigid fixation of the implant body. The tooth socket including measurements of the mesio-distal width and socket depth is evaluated. Studies have shown that implants placed into ≥ 3mm of mature bone apical to the socket demonstrate high success rates. Anatomical structures located apical to the socket such as the nasal cavity, maxillary sinus or inferior alveolar nerve may limit the depth of implant placement.

The surgical stage is initiated with a flapless atraumatic extraction with emphasis on expansion and support of the buccal plate. The reflection of a mucoperiosteal flap compromises blood supply leading to bone and soft tissue loss and is to be avoided during the extraction and implant placement procedure.[18-20] Complete debridement of the socket is performed followed by implant placement. Several studies have demonstrated high success rates with flapless implant surgical procedures. An undersized osteotomy is developed with a palatal skew engaging at least 3mm of native bone apical to the socket. Implant position is critical for initial fixation and long term success. Rigid fixation is achieved with an undersized osteotomy preparation, engagement of native and bony socket walls and a torque value of greater than 35 Newton centimeters.[21] A high torque value is considered the most critical requirement for placement of a provisionalization.[22] Implant designs that create higher torque values are characteristic of aggressive thread designs, microtextured surfaces and lengths greater than 12mm.[23] The implant platform is positioned in relation to the ideal midfacial gingival margin producing an emerging profile.[24,25] The implant body is to be placed at least 1.5mm away from an adjacent tooth to preserve the interproximal bone peak and dental papilla.[26]

Guided bone regeneration serves a crucial role in the IIPP process. The space located between the implant and the residulal tooth socket referred to as the "gap" requires management at the time of surgery. Research has exhibited that "gap" distances <4.2mm spontaneous fill if the buccal plate of bone is present without the need for primary flap closure. The gap fills with bone reminiscent of a healing socket.[27] However, many clinicians tend to fill gaps with autografts, allografts, xenografts or alloplasts.

Platelet rich plasma (PRP) and fibrin (PRF) concentrate platelets containing growth factors responsible for recruitment, differentiation and proliferation of cells.[28,29] Platelet derived growth factor (PDGF), transferring growth factor Beta 1, 2 (TGFB1,2) and bone morphiogenic protein (BMP) have been indicated to be major growth factors. PRF is an autologous healing biomaterial rich in growth factors and glycoproteins. The strong fibrin architecture containing PDGF, TGFB-1, Fibronectin, Vitronectin and numerous other cytokines encourage hemostasis through the migration of fibroblasts and endothelial cells.[30] Platelet concentrates have demonstrated enhanced healing of soft and hard tissues with decreased pain. PRP/PRF can be developed from whole blood and standard phlebotomy principles with an inexpensive centrifuge and associated disposables.[31]

The restorative stage is initiated at surgical placement based on studies that elicit stable soft and hard tissue when the IIPP approach is employed.[32] A fixture level impression captures the angulation and position of the implant body as well as the existing ideal gingival sulcus which allows for the fabrication of the final abutment and crown during the osseointegrative period. This approach reduces overall treatment time by eliminating appointments specific to the restorative aspect. Moreover, it limits the amount of connections and disconnections of component parts, thus reducing soft tissue migration.

The provisionalization aspect of IIPP preserves the existing osseous and gingival architecture by providing instant mechanical support to the papillae and midfacial gingival tissues.[33] Furthermore, it maintains the gingival embrasure form providing comfort and esthetics.[34] The fabrication of a provisional restoration is to be performed prior to bone grafting. After fabrication, placement of a tall, thin healing collar seals the internal aspect of the implant allowing for bone grafting of the site.[35,36] Patients feel that a provisional crown is a real tooth and prefer it over a removable partial denture.

The final prosthesis provides a long-term predictable solution for a missing tooth through the utilization of state of the art biomaterials. Abutment and crown materials are an important factor on recession and how it relates to esthetics. A zirconium abutment is a highly biocompatible material that provides soft tissue stability biologically and optically.[37,38] A flat or undercontoured abutment and an all-ceramic crown with a slightly undercontoured gingival buccal margin creates esthetically pleasing restorations with soft tissue stability.[39] This design concept is based on the horizontal component of the biological width around implants where platform switching, undercontoured abutments and concave crowns have exhibited less gingival recession.[40]

Implant occlusal principles are employed to maintain initial and long-term osseointegration. The provisionalization follows an implant occlusal principle (IPO) scheme of zero contact in centric occlusion, lateral excursions and protrusion. The incisal edge is designed shorter than the corresponding adjacent tooth.[41] The final definitive restoration follows IPO principles with the incisal edge fabricated at the ideal length.

Conclusion

Implant therapy is considered the treatment of choice for single tooth replacement. The prolongation of treatment encourages patients to select less than ideal treatment alternatives. Immediate implant placement with provisionalization (IIPP) decreases the treatment period for patients. IIPP has demonstrated high success rates when rigid fixation of the implant is achieved with the existence of the buccal plate of bone. This case report demonstrates an implant approach that provides stable bone levels, ideal esthetics with less surgery, less pain and the elimination of a removable partial denture transitional stage to rehabilitate a missing tooth.

References: Please see the online version at www.nysagd.org.

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References for Immediate Implant Placement and Provisionalization: A Case Report, page 12

1. 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.

2. Georgios R, Froum S, Cyril H, Sang-Choon Cho, Dennis Tarnow. Survival Rate of Immediately vs Delayed Loaded Implants: Analysis of the Current Literature. *J Oral Implantol.* 2010;41:315-324

3. Lang NP, Lui P, Lau KY, Wong MCM. A systematic review on survival and success rates of implants placed immediately into fresh extraction sockets after at least 1 year. *Clin Oral Impl Res.* 23(Suppl. 5), 2012, 39-66.

4. Elian N, Cho S, Froum S, Smith R, Tarnow D. A simplified socket classification and repair technique. *Aesthet Dent* 2007:19(2):99-104

5. Branemark P-I. Osseointegration and its experimental background. *J Prosthet Dent.* 1983;50:399-410.

6. Schroop L, Isidor F, Kostopoulos L, Wenzel A. Patient experience of, and satisfaction with, delayed-immediate vs delayed single-tooth implant placement. *Clin Oral Implants Res.* 2004;15:498-503

7. Barzilay I, Graser Gn, Canton J, Shenkle G. Immediate implantation of pure titanium threaded implants into extraction sockets. *J Dent Res.* 1988;67:234.

8. Barzilay I, Graser G, Iranpour B, Naiella JR. Immediate implantation of a pure titanium implant into an extraction socket: Report of a pilot procedure. Int J Oral Maxillofac Implants 1991;6:277-284

9. 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

10. Norton MR. A short-term clinical evaluation of immediately restored maxillary TiOblast single-tooth implants. *Int J Oral Maxillofac Implants* 2004; 19: 274-281

11. Wohrle PS. Single tooth replacement in the aesthetic zone with immediate provisionalization. Fourteen consecutive case reports. *Prac Periodontics Aesthet Dent* 1998;10:1107-1114

12. Bengazi F, Wennstrom JL, Lekholm U. Recession of the soft tissue margin at oral implants. A 2-year longitudinal prospective study. *Clin Oral Implants Res.* 1996;4:303-310

13. Grunder U. Stability of the mucosal topography around single-tooth implants and adjacent teeth: 1 year results. *Int J Periodontics Restorative Dent.* 2000;20:11-17

14. Kan JY, Rungcharassaeng K, Lozzada J. Immediate placement and provisionalization of maxillary anterior single implant: A. *Int J Oral Maxillofac Implants.* 2003; 18:31-39

15. Touati B. Biologically driven prosthetic options in implant dentistry. *Pract Proced Aesthet Dent* 2004;16(7):517-520

16. Kois JC. Predictable single tooth peri-implant esthetics: Five diagnostic keys. *Compend Contin Educ Den.* 2001;22:199-208.

17. Kois J. Altering gingival levels: The restorative connection. Part I: Biologic Variables. *J Esthet Dent* 1994: 6; 3-9

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

19. Bragger U, Pasquali I, Komman KS. Remodeling of interdental alveolar bone after periodontal flap procedures assessed by means of computer assisted densilometric image analysis (CADIA). *J Clin Periodontol.* 1998;15:558-564

20. Wilderman MN. Exposure of bone in periodontal surgery. *Dent Clin North Am* 1964;3:23-36

21. Landsberg CJ, Bichacho N. Implant placement without flaps: A single-stage surgical protocol-Part I. *Pract Periodont Aesthet Dent* 1998;10(8):1033-1039

22. Kan JYK, Rungcharassaeng K. Immediate placement and provisionalization of maxillary anterior single implants. A surgical and prosthodontic rationale. *Pract Periodont Aesthet Dent* 2000; 12(9):817-824

23. Dilek O, Tezulas E, Dincel M. Required minimum primary stability and torque values for immediate loading of mini dental implants: an experimental study in nonviable bovine femoral bone. *Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology.* 2008;105:e20-7.

24. Wong M, Eulenberger J, Schenk R, Hunziker E. Effect of surface topology on the osseointegreation of implant materials in trabecular bone. *J Biomend Mater Res.* 1995;29:1567-1575

25. Smukler H, Castellucci F, Capri D. The role of implant housing is obtaining aesthetics: Generation of peri-implant gingiva and papillae-Part I. *Pract Proced Aesthet Dent* 2003; 15(2) 141-149

26. Saadoun AP, LeGall M, Touati B. Selection and ideal tridimensional implant position for soft tissue aesthetics. *Pract Periodont Aesthet Dent* 1999; 11(9) 1063-1072

27. Esposito M, Ekestubbe A, Grondahl K. Radiological evaluation of marginal bone loss at tooth surfaces facing single Branemark Implants. *Clin Oral Impl Res.* 1993; 4(3):151-157

28. 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(5):515-521

29. Marx RE, Carlson ER, Eichstaedt Rm, Schimmele SR, Strauss JE, Georgeff KR. Platelet-rich plasma: Growth factor enhancement for bone grafts. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998; 85(6);638-646

30. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Mouhyi J, Dohan DM. Platelet rich fibrin (PRF): a second generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3)e56-60

31. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Mouhyi J, Dohan DM. Platelet Rich Fibrin (PRF): a second generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101 (3):e56-60

32. Dohan Ehrenfest DM, de Peppo GM, Doglioli P, Sammarino G. Slow release of growth factors and thrombospondin-1 in Choukroun's platelet-rich fibrin (PRF): a gold standard to achieve for all surgical platelet concentrates technologies. *Growth Factors* 2009;27 (1): 63-69

33. 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.

34. Lazzara RJ. Immediate implant placement into extraction sites: Surgical and restorative advantages. *Int J Periodont Rest Dent.* 1989;9(5):333-343

35. 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

36. Touali B, Guez G, Saadoun A. Aesthetic soft tissue integration and optimized emergence profile: Provisionalization and customized impression coping. *Prac Periodont Aesthet Sent* 1999;11(3)305-314

37. Chu SJ, Salama MA, Garber DA, et al. Flapless postextraction socket implant placement: part 2. The effect of bone grafting and/or provisional restoration on peri-implant mucosal tissue height and thickness-a retrospective study. *Int J Periodontics Restorative Dent.* 2015;35(6):1-10

38. Chu S, Salama M, Garber D, et al. Flapless postextraction socket implant placement, part II: The effects of bone grafting and provisional restoration on peri-implant soft tissue height and thickness-A retrospective study. *Int J Periodontics Restorative Dent.* 35.6(2015):803-809

39. Rompen E, Touati B, Van Dooren E. Factors influencing marginal remodeling around implants. *Pract Proced Aesthet Dent* 2003;15(10): 754-761

40. Linkevicius T, Vaitelis J. The effect of zirconia or titanium as abutment material on soft peri-implant tissues: a systematic review and meta-analysis. *Clin Oral Implants Res.* 2015;26:1-9

41. Chu S, Salama M, Salama H, Garber D, Saito H, Sarnachiaro G, Tarnow D. The Dual-Zone Therapeutic Concept of Managing Immediate Implant Placement and Provisional Restoration in Anterior Extraction Sockets. *Compend Contin Educ Dent.* 2012;(33)524-534

42. Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. *Int J Periodontics Restorative Dent.* 2006;26(1):9-17

43. Testori T, Bianchi F, Del Fabbro M, et al. Immediate non-occlusal loading vs early loading in partially edentulous patients. *Pract Proced Aesthet Dent* 2003; 15(10): 787-794