

Case Report

Immediate implant placement and provisionalization after staged approaches of apicoectomy and guide tissue/bone regeneration in the anterior maxilla: A clinical report

Ho-Fu Cheng, DDS

Clinical instructor, Division of Prosthodontics,
Department of Dentistry, Chi Mei Medical
Center, Tainan, Taiwan

Chih-Wen Cheng, DDS

Assistant professor, Division of
Prosthodontics, Department of Dentistry, Chi
Mei Medical Center, Tainan, Taiwan

Lian-Ping Mau, DDS, MS

Assistant professor, Division of Periodontics,
Department of Dentistry, Chi Mei Medical
Center, Tainan, Taiwan

Running title: Immediate implant placement
and provisionalization

Corresponding author:

Dr. Chih-Wen Cheng

Division of Prosthodontics, Department of
Dentistry, Chi Mei Medical Center
No. 901, Zhonghua Rd., Yongkang Dist.,
Tainan City 71004, Taiwan (R.O.C).
E-mail: e7752327@gmail.com

The authors reported no conflicts of interest
related to this study.

DOI: 10.6926/JPI.201910_8(4).0003

Abstract

In order to maintain esthetics immediately after maxillary anterior tooth extraction, immediate implant placement and provisionalization (IIPP) is one of the current options for implant reconstruction. However, esthetic outcome after IIPP is depended on proper condition of the preexisting tissue. This clinical report introduces the strategy of apical surgery and guided tissue/bone regeneration before tooth extraction to improve the preexisting tissue condition. It could not only achieve the patient's esthetic demand, but also prevent the risk factors for IIPP.

Key words: apical surgery, guided bone regeneration, guided tissue regeneration, immediate implant placement, immediate provisionalization

Introduction

The reconstruction of partially or fully edentulous patients with implant-supported prostheses has become a reliable and predictable treatment option resulting in high survival rates¹. However, it's still a challenge to achieve a satisfying esthetic outcome with healthy and stable peri-implant tissues in harmony with the adjacent natural teeth in anterior maxilla by using implant restorations. Three implant protocols have been evolved based on the different surgical conditions and surgeon demanding, including immediate, early and delayed implant placement.

There is a growing tendency to place implants immediately after tooth extraction, combined with immediate provisionalization. Immediate implant placement was initially described by Schulte and Heimke in the 1980s². Thereafter, the protocol of immediate loading was initially developed for improving patient's comfort through immediate function and esthetics. Since 1998, after Wohrle first demonstrated success with immediate implant placement and provisionalization (IIPP) of single anterior maxillary implants, numerous clinical studies have confirmed the viability of such treatments³. One of the most desirable features is the efficiency in optimizing esthetic success by preserving the existing osseous and gingival architecture. In addition, reduction in the number of surgical interventions, a shorter treatment time, an ideal three-dimensional implant positioning and especially, esthetic appearance and space maintenance during surgical healing period have been claimed as the advantages of this

treatment approach⁴. Moreover, it is also a predictable procedure with a high success rate. According to a prospective study by Kan et al⁵, with an average observation period of four years (2 to 8.2 years), the cumulative success rate of 35 anterior single implants by using immediate implant placement and provisionalization (IIPP) was 100%. The systematic review by Paul Weigl included 626 censored IIPP in 609 patients showed a success rate of 97.96% and a survival rate of 98.25% after a mean follow-up period of 31.2 months⁶. It provides not only early healing of the soft tissue surrounding the implant, but retains the alveolar crest and maintain the gingival architecture surrounding the implant. When immediate implant placement is combined with immediate provisional prosthesis restored, it will also decrease gingival change, especially for papilla height maintenance. Many authors had claimed that IIPP is effective in maintaining the existing papilla height without the risk of creating scar tissue, when flapless approach is implemented^{7,8}.

Esthetic outcome after IIPP is depended on proper condition of the preexisting tissue, such as a thick gingival biotype, an appropriate gingival level, osseous-gingival relationship, and the presence of adequate buccal bone plate⁹. It increases the risk of facial gingival recession in the cases with thin tissue biotype or facial bone dehiscence. Moreover, primary stability, control of micro-motion, and ideal implant position are also key factors to influence the success rates of IIPP¹⁰. The surgical protocol of IIPP should include the evaluation of bone quality, proper implant size choosing, and palatal insertion in flapless approach to achieve adequate implant primary stability and preserve labial bone

plate. Then, the bone grafts at the gap between the implant and labial bone plate combined with facial connective tissue graft will also reduce the incidence of gingival recession and labial bone resorption after provisional implant prosthesis delivered^{11,12}.

This clinical report introduces the strategy of apical surgery and guided tissue/bone regeneration before single tooth extraction or combined serial tooth extraction to improve the preexisting tissue condition before IIPP achieving the esthetic outcomes.

Clinical report

Case 1:

A 47-year-old woman, had suffered from biting pain for a long time in the anterior maxilla. After comprehensively clinical and radiographic examinations (Fig. 1), a large periapical lesion was noted at maxillary left central incisor. No gingival swelling, inflammation, or deep probing depth above 3 mm were observed in the clinical examination. Tooth extraction was indicated due to insufficient remaining tooth structure and poor crown-to-root ratio after removing the previous metal-ceramic crown. The diagnosis was an apical cyst with a previously treated root canal. Because of patient's esthetic demand during healing period, IIPP was preferable and planned. However, the computed tomographic (CT) images showed insufficient vertical bone height for implant primary stability because of the apical lesion. Therefore, apical surgery and guide bone regeneration were planned prior to tooth extraction and implant

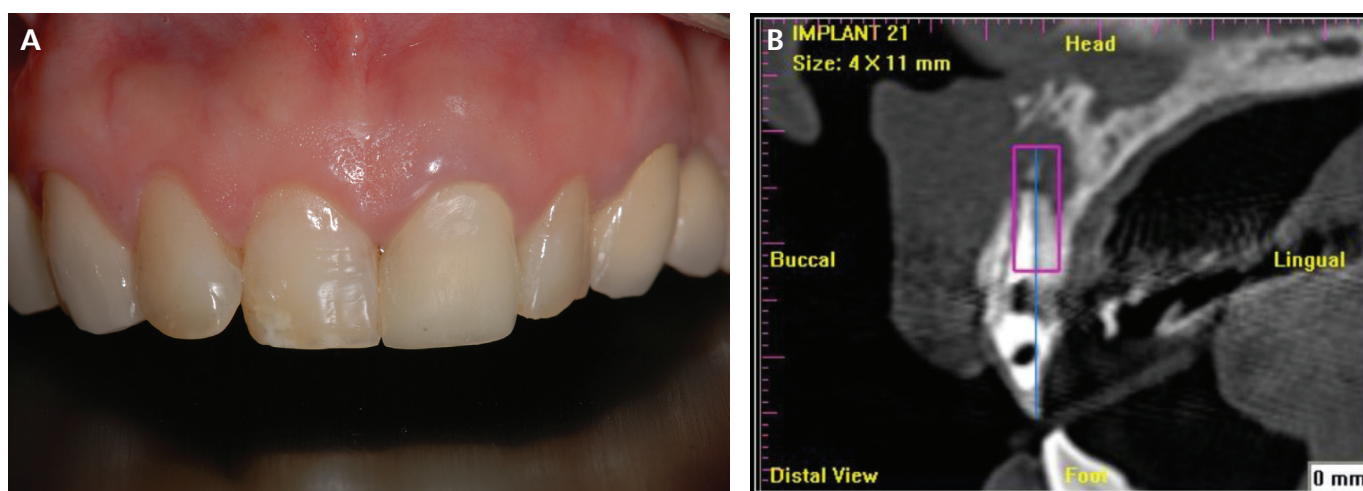


Figure 1. (a) Provisional crown on maxillary left central incisorPt, (b) CT image showed a large periapical lesion.

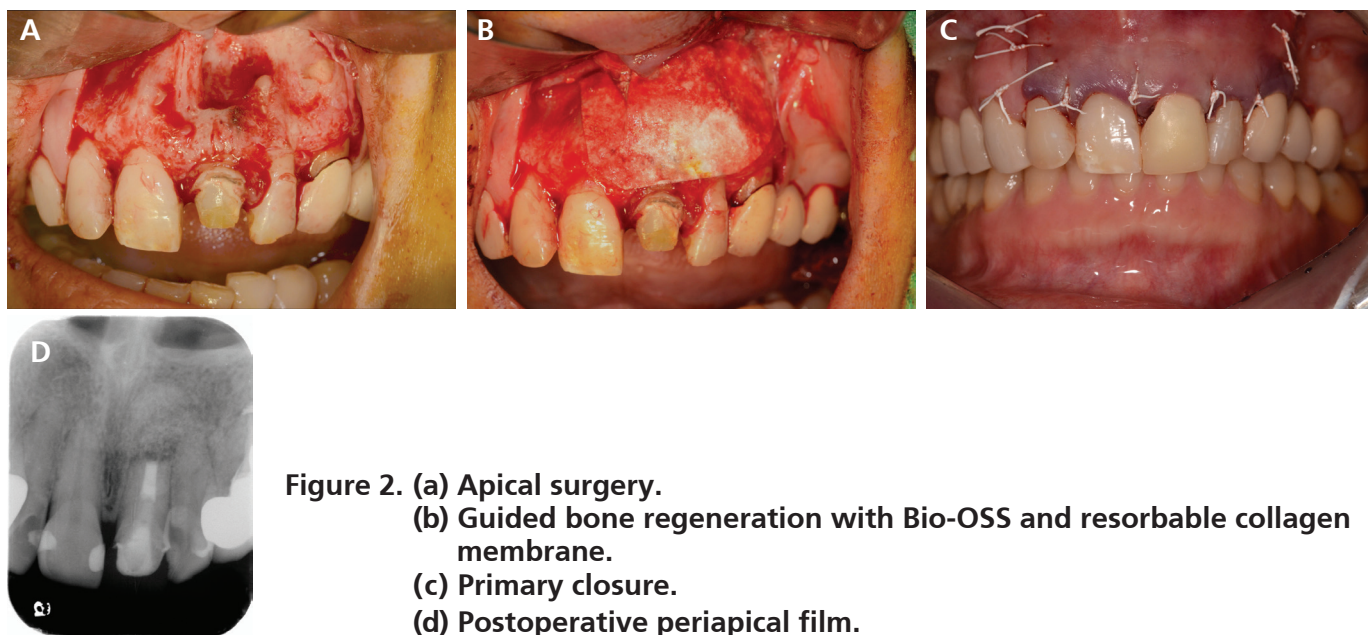


Figure 2. (a) Apical surgery.
(b) Guided bone regeneration with Bio-OSS and resorbable collagen membrane.
(c) Primary closure.
(d) Postoperative periapical film.

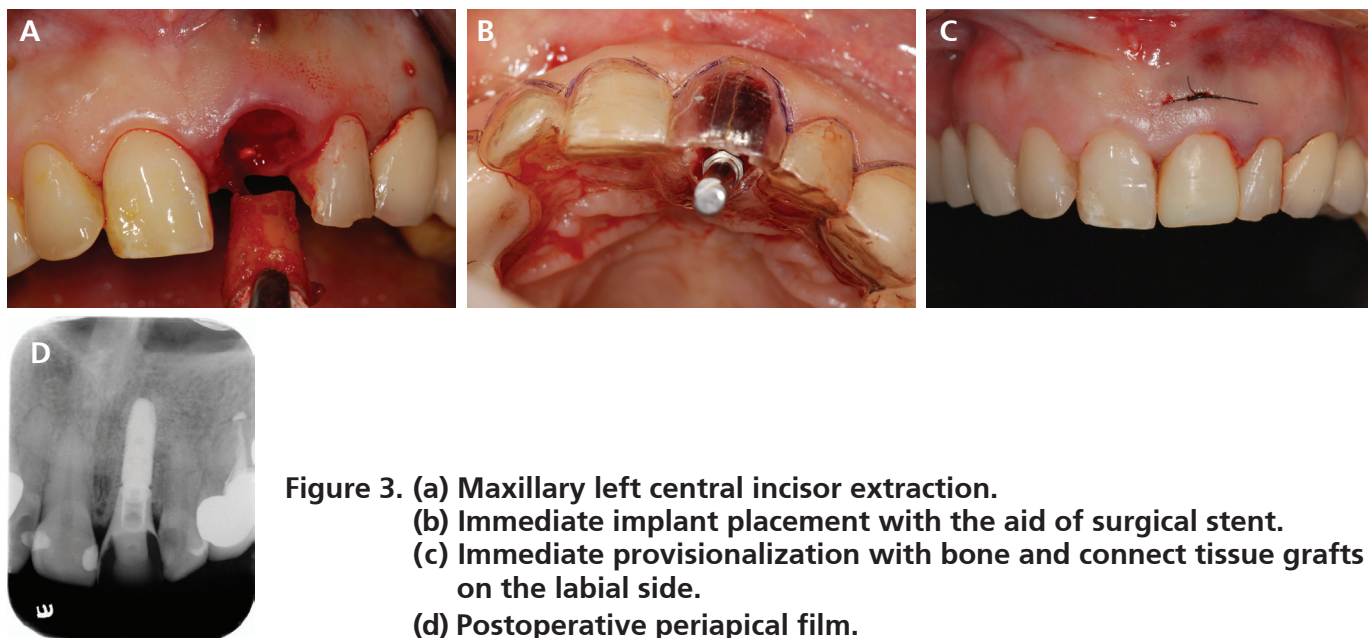


Figure 3. (a) Maxillary left central incisor extraction.
(b) Immediate implant placement with the aid of surgical stent.
(c) Immediate provisionalization with bone and connect tissue grafts on the labial side.
(d) Postoperative periapical film.

placement for the preparation of the pre-existing tissue condition. Regarding the apical surgery, cyst enucleation, apicoectomy, and retrograde filling with mineral trioxide aggregate (ProRoot MTA, Dentsply) were performed. Then, guided bone regeneration was performed with xenograft (Bio-OSS, Geistlich) and resorbable collagen membrane (EZ Cure, Biomatlante) (Fig. 2).

After bone healing for 8 months, maxillary left central incisor was extracted atraumatically, and an implant (OsseoSpeed™ EV, 3.6×11mm, Astra Tech) was inserted with primary stability of $\geq 30 \text{ Ncm}^2$ by using flapless approach. Auto-polymerized bisacrylic composite resin (Protemp 3 Garant; 3M ESPE) and titanium temporary abutment (Temp Abutment EV, Astra Tech) were used to make the screw-retained provisional crown. Then, the

gap between the implant and labial bone plate was filled with bone grafts (FDBA, LifeNet) after implant-supported provisional crown inserted intra-orally without neither centric or eccentric occlusal contact. Thereafter, connective tissue graft harvested from maxillary palatal mucosa was applied on the facial side (Fig. 3).

After 3 months of osseointegration, final impression was made by using customized impression coping and polyvinyl siloxane (Aquasil Ultra XLV and Aquasil Soft Putty; Dentsply Caulk), and the definitive screw-retained implant-supported crown with porcelain-fused-to-zirconia design (Ceramill Zi, Amann Girrbach AG; veneer porcelain: Vita VM9) was delivered¹²⁻¹⁴. It achieved a satisfied pink and white esthetic outcomes in harmony with the adjacent natural teeth



Figure 4. Insertion of definitive screw-retained implant-supported crown.



Figure 5. Three-year follow up.

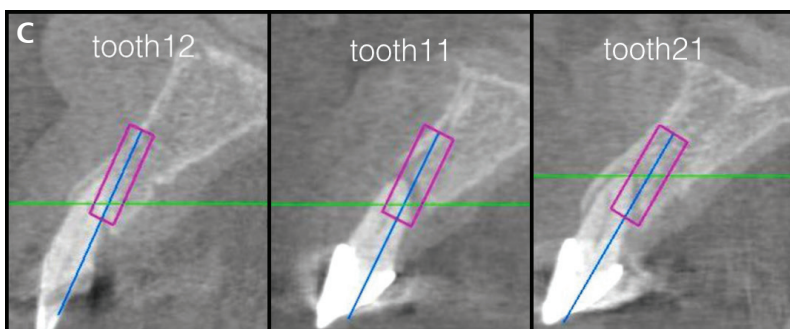
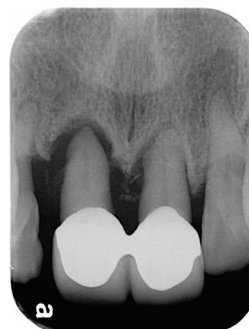
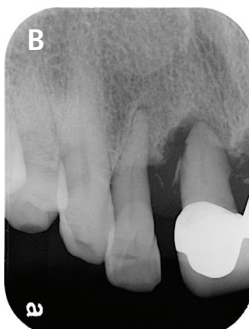


Figure 6. (a) Initial condition with ill-fitting splinted crowns on maxillary bilateral central incisors. (b) Periapical film showed severe periodontal destruction. (c) CT image showed insufficient labial bone width.



Figure 7. Delivery of provisional FDPs after maxillary right central incisor extracted.

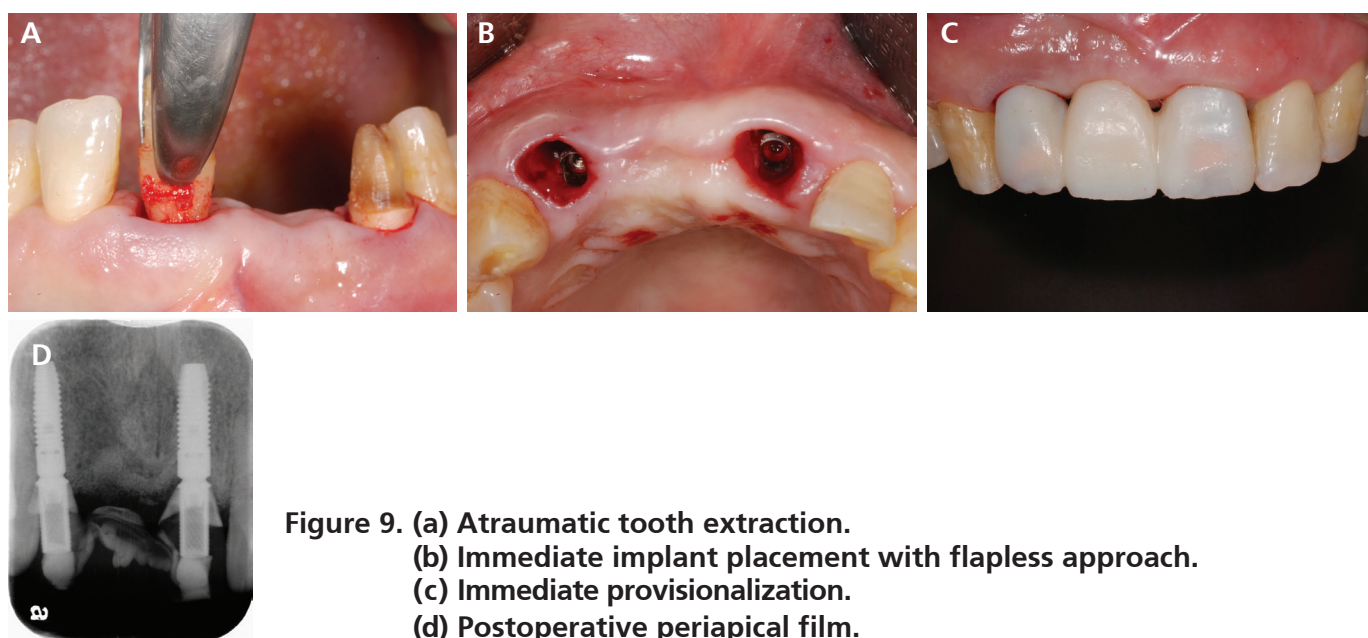
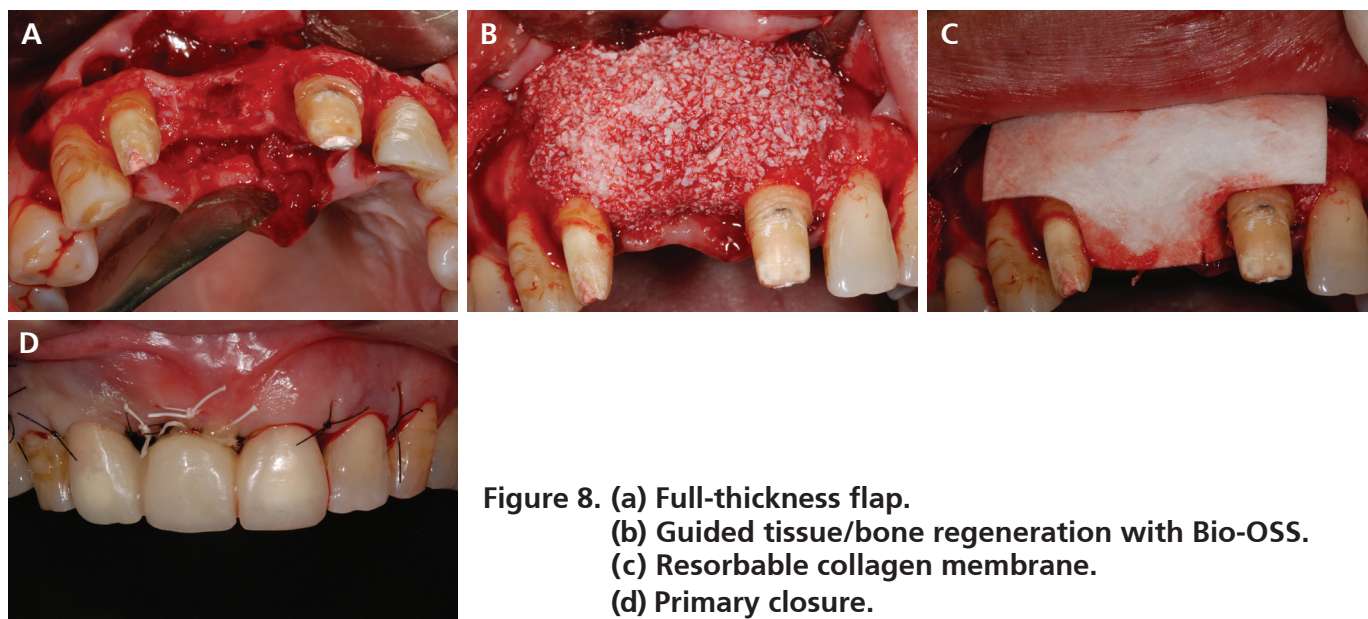
(Fig. 4). There were no biological or mechanical complications at the 3-year follow-up visit (Fig. 5).

Case 2:

A 66-year-old woman came for help due to pain and poor esthetic appearance. After comprehensively clinical and radiographic examinations (Fig. 6), there were ill-fitting splinted crowns of maxillary bilateral central incisors with a large space between maxillary right central and lateral incisors. Extraction of all the three teeth was indicated due to severe periodontal bone loss. However, patient didn't want to wear removable prosthesis because of compromised esthetics and discomfort. Therefore, IIPP was a preferable choice, but there was insufficient bone width in the CT images for immediate implant placement.

To improve the preexisting tissue condition before IIPP, serial tooth extraction was a strategic method. Maxillary right central incisor was removed first, and a three-unit provisional fixed dental prostheses (FDPs) retained by maxillary right lateral incisor and left central incisor was delivered (Fig. 7). Then, guided tissue regeneration was performed on maxillary right lateral incisor and left central incisor combined with guided bone regeneration on the edentulous ridge of maxillary right central incisor with xenograft (Bio-OSS, Geistlich) and resorbable collagen membrane (EZ Cure, Biomatlante) (Fig. 8).

After 8 months for hard and soft tissue healing, maxillary right lateral incisor and left central incisor was extracted atraumatically, and two implants (OsseoSpeed™ TX, 3.5×13mm for right lateral incisor and 4.0×13mm for left central incisor,



Astra Tech) were inserted immediately with primary stability of ≥ 30 Ncm² by using flapless approach. Auto-polymerized bisacrylic composite resin (Protemp 3 Garant; 3M ESPE) and titanium temporary abutments (Temp Abutment TX, Astra Tech) were used to make the screw-retained

provisional FDPs. Then, the gaps between the implants and labial bone plates were filled with bone grafts (FDBA, LifeNet) after insertion of the implant-supported provisional FDPs. Occlusal adjustment was done to ensure neither centric nor eccentric occlusal contact (Fig. 9).

After 3 months of osseointegration, final impression was made by using splinted customized impression copings and polyvinyl siloxane (Aquasil Ultra XLV and Aquasil Soft Putty; Dentsply Caulk), and the definitive screw-retained implant-supported FDPs with porcelain-fused-to-zirconia design (Ceramill Zi, Amann Girrbach AG; veneer porcelain: Vita VM9) was delivered¹³⁻¹⁵. The outcome with harmonious gingival level and adequate papilla height was achieved in this case (Fig. 10). There were no biological or mechanical complications at the 4-year follow-up visit (Fig. 11).

Discussion

IIPP in the anterior maxilla was advocated with advantages including social and psychological issues (shorter treatment time), function (correct placement permitting axial loads) and esthetics (tissue preservation). In these two cases, the pre-existing tissue condition and primary stability were critical problems for IIPP. Because of the infected tissue and severely periodontal bony destruction, both cases were unable to achieve enough primary implant stability, and were contra-indicated for IIPP. When a clinician encounters a case with such a poor soft and hard tissue condition, the early or delayed implant placement protocol may be the more reasonable option. But it will take a long time and cost to rebuild the residual ridge with tremendous soft and hard tissue resorption following infected tooth extraction^{16,17}. Surgeons would usually perform techniques, such as ridge preservation with guided bone regeneration and soft tissue graft, to achieve esthetic and functional outcomes. But there is still in dilemma for both patient and clinician. Even though there had been reported reliable reconstruction outcomes and success rates¹⁸, the technically sensitive procedures and time-consuming healing period were also the problems to clinicians. Moreover, patient needs to endure unesthetic appearance and uncomfortable experience with denture or even no provisional prosthesis during a long healing period.

In the first case, the apical surgery and guided bone regeneration was strategically performed first to eliminate infection source from maxillary left central incisor and rebuilt apical hard tissue for adequate primary stability for IIPP. Moreover, patient can keep her esthetic appearance during a long healing period without a removable denture. In the second case, the serial tooth extraction and guided tissue/bone regeneration was combined

to improve the pre-existing tissue condition. There were some obvious benefits from serial tooth extraction procedure, such as preventing severe soft and hard tissue collapse, and being able to keep provisional FDPs for maintaining esthetics and occlusal function during soft and hard tissue healing after surgical reconstruction. Moreover, the inter-proximal bone crest and papillae could be preserved in such a case with multiple adjacent missing teeth. The patient might be needed for a more complicated and numerous guided bone regeneration and soft tissue graft, if early or delayed implant placement protocol was implemented, which might also lead to an unpredictable esthetic outcome by losing papilla eventually.

In summary, these two cases were presented in patients with maxillary anterior teeth extracted and planned for IIPP for better esthetics by changing the sequence of tooth extraction and the timing of surgical reconstruction to make the ideal pre-existing tissue conditions. It showed not only esthetic appearance and patient's comfort increased, but also the number of operation times reduced. However, careful case selection, accurate diagnosis and clear communication between the clinicians and patients are the success keys for the esthetic outcome. The patient with in-cooperate psychological status, poor oral hygiene maintenance, existed tremendous hard and soft tissue destruction, and the dental infected source which cannot be eliminated were contra-indication to this treatment application. More researches are needed for better understanding these application aspects and the long-term success rates.

References

1. Papaspyridakos P, Chen CJ, Singh M, Weber HP, Gallucci GO. Success criteria in implant dentistry: a systematic review. *J Dent Res* 2011; 91: 242-8.
2. Schulte W, Heimke G. The Tübinger immediate implant. *Quintessenz* 1976; 27: 17-23.
3. Wohrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization: fourteen consecutive cases reports. *Pract Periodontics Aesthet Dent* 1998; 10: 1107-1114.
4. Chen ST, Wilson TG Jr, Hammerle CH. Immediate or early placement of implants following tooth extraction: review of biologic basis, clinical procedures, and out-comes. *Int J Oral Maxillofac Implants* 2004; 19: 12-25.
5. Kan JY, Rungcharassaeng K, Lozada JL, Zimmerman G. Facial gingival tissue stability following immediate placement and provisionalization of maxillary anterior single implants: a 2- to 8-year follow-up. *Int J Oral Maxillofac Implants* 2011; 26: 179-87.
6. Weigl P, Strangio A. The impact of immediately placed and restored single-tooth implants on hard and soft tissues in the anterior maxilla. *Eur J Oral Implantol* 2016; 9: 89-106.
7. Buser D, Chen ST, Weber HP, Belser UC. Early implant placement following single-tooth extraction in the esthetic zone: biologic rationale and surgical procedures. *Int J Periodontics Restorative Dent* 2008; 28: 441-51.
8. Kan JY, Rungcharassaeng K. Site development for anterior single implant esthetics: the dentulous site. *Compend Contin Educ Dent* 2001; 22(3): 221-6.
9. Kois JC. Predictable single-tooth peri-implant esthetics: five diagnostic keys. *Compend Contin Educ Dent* 2004; 25: 895-900.
10. Kan JY, Rungcharassaeng K. Immediate placement and provisionalization of maxillary anterior single implants: a surgical and prosthodontic rationale. *Pract Periodontics Aesthet Dent* 2000; 12: 817-24.
11. Yoshino S, Kan JY, Rungcharassaeng K, Roe P, Lozada JL. Effects of connective tissue grafting on the facial gingival level following Single immediate implant placement and provisionalization in the Esthetic Zone: a 1-year randomized controlled prospective study. *Int J Oral Maxillofac Implants* 2014; 29: 432-40.
12. Khzam N, Arora H, Kim P, Fisher A, Mattheos N, Ivanovski S. Systematic review of soft tissue alterations and esthetic outcomes following immediate implant placement and restoration of single implants in the anterior maxilla. *J Periodontol* 2015; 86: 1321-30.
13. Cheng CW, Chien CH, Chen CJ, Papaspyridakos P. Complete-mouth implant rehabilitation with modified monolithic zirconia implant-supported fixed dental prostheses and an immediate-loading protocol: a clinical report. *J Prosthet Dent* 2013; 109: 347-52.
14. Cheng CW, Chien CH, Chen CJ, Papaspyridakos P. Clinical results and technical complications of posterior implant-supported modified monolithic zirconia single crowns and short-span fixed dental prostheses: a 2-year pilot study. *J Prosthodont* 2018; 27: 108-14.
15. Cheng CW, Chien CH, Chen CJ, Papaspyridakos P. Randomized controlled clinical trial to compare posterior implant-supported modified monolithic zirconia and metal-ceramic single crowns: one-year results. *J Prosthodont* 2019; 28: 15-21.
16. 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: 313-23.
17. Araujo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. *J Clin Periodontol* 2005; 32: 212-28.
18. Misch CE, Misch-Dietsh F, Silc J, Barboza E, Cianciola LJ, Kazor C. Posterior implant single-tooth replacement and status of adjacent teeth during a 10-year period: A retrospective report. *J Periodontol* 2008; 79: 2378-82.