

Case Report

The Application of the Root Submergence Technique for Pontic Site Development in Esthetic Implant Restorations

Jui-Chung Chang, D.D.S., M.S.

Director,
Department of Prosthodontics,
Chi Mei Medical Center,
Tainan, Taiwan

Chun-Jung Chen, D.D.S

Attending Doctor
Department of Periodontics
Chi-Mei Medical Center
Tainan, Taiwan

Corresponding author:

Jui-Chung Chang, D.D.S., M.S.

Director,
Department of Prosthodontics,
Chi Mei Medical Center,
Tainan, Taiwan

Tel: +886-6-282-8928
E-mail: csg129@gmail.com

Abstract

Maxillary anterior teeth play an important role in terms of esthetics. In the event that these teeth are extracted, the collapsed arch form will occur due to bone resorption in both the vertical and horizontal directions. Many surgical techniques have been used to attempt to compensate for such bone resorption; however, the results have not always been satisfactory, especially in the pontic areas. The root submergence technique refers to the practice of resecting the crown of a tooth in order to preserve the root. This approach allows for the original ridge profile to be maintained without additional periodontal surgery. This case report describes how to develop the pontic area in the implant esthetic area through use of the root submergence technique.

Key words: root submergence technique, esthetic, pontic development

Introduction

Maxillary anterior teeth play a key role in esthetics. Not only do they provide lip support, but they also help to maintain the facial profile. In the event that these teeth are extracted, the collapsed arch form will occur due to bone resorption in both the vertical and horizontal directions.¹ Relatedly, a prosthesis in the pontic area will be longer and narrower compared to natural dentition. Consequently, a compromised esthetic appearance will result.

Many surgical techniques have been used in order to compensate for bone resorption after tooth extraction, including socket preservation, guided bone regeneration, and immediate implant placement. Although the use of these techniques is prevalent, the effectiveness of such treatments is limited.²⁻⁵ It has been suggested, for example, that the socket preservation technique may not totally preserve the alveolar ridge at the extraction site.^{6,7} Meanwhile, although guided bone regeneration has been used in localized ridge augmentation, the results in terms of preservation of interproximal bone are compromised.^{2,5} Furthermore, while immediate implant placement has been used to minimize bone resorption at the extraction site, the end result is still heavily dependent on the gingival biotype and buccal bone thickness.⁸



Fig. 1 Intra-oral view before treatment (a) Clinical view, (b) Periapical radiograph

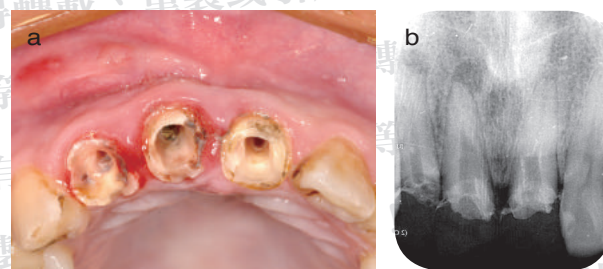


Fig. 2 Remaining tooth structure after post and core removing (a) Clinical view, (b) periapical radiograph

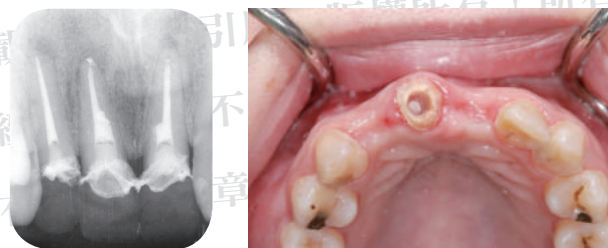


Fig. 3 Periapical radiograph after extraction of maxillary right lateral incisor and left root canal treatment

Case report

A 35-year-old woman sought dental treatment due to a toothache in the anterior maxilla lasting for many days. She denied any systemic diseases or drug allergies. A clinical examination revealed an ill-fitting prosthesis and recurrent caries on both maxillary central incisors and the right lateral incisor. Also, a post and core with periapical lesions were noted on the periapical radiograph (Fig. 1). These teeth were diagnosed with symptomatic apical pathosis and generalized gingivitis.

Two treatment options, namely, the use of either a fixed partial denture or implant, were discussed with the patient. She agreed to remove the existing prosthesis first and then to undergo further evaluation of her dental conditions. After removing the prosthesis with the post and core, the maxillary right lateral incisor and left central incisor revealed subgingival decay with insufficient tooth structures. Meanwhile, a vertical fracture line was noted on the palatal side of the maxillary left central incisor. Both teeth showed an unfavorable prognosis, and extraction of both was indicated. The tooth structure of the maxillary right central incisor was compromised due to the thin dental wall and limited length of the root (Fig. 2). The definitive treatment plan involved extraction of the maxillary right lateral incisor and left central incisor and their replacement with implants. Due to financial considerations, the patient preferred straightforward treatment to extensive periodontal surgery. In order to maintain the dimension and arch form of the maxillary right central incisor, the root submergence technique was chosen at the pontic area without extensive periodontal surgery.

To relieve the symptoms of the patient, endodontic therapy was performed on these teeth (Fig. 3). When the periapical pathology subsided on the radiograph, the maxillary right

The root submergence technique refers to the practice of resecting the crown of a tooth in order to preserve the root, which is covered with secondary healing or a soft tissue flap. The purpose of this technique is to prevent bone resorption, maintaining the papilla height and width without additional periodontal surgery. In the late 1950s, the technique was initially advocated to improve the retention and resistance of complete dentures.⁹⁻¹¹ Likewise, it can be applied to a fixed prosthesis in the pontic area by removing the crown of a tooth and leaving the root to yield an improved esthetic result.^{12,13} The root can be removed to 2 mm subgingivally, and then covered by soft tissue graft or left alone until secondary wound healing occurs. Although the technique is easier to perform than extensive periodontal surgery, the degree of success depends on the conditions of the roots. The technique should not be used in cases of unhealthy roots, including roots with caries; external root resorption; or progressive endodontic and periodontal combined lesions.¹⁴

The case reported on below involved the use of the root submergence technique in the pontic site development of anterior maxilla implant restorations.



Fig. 5 Implant placement on maxillary right lateral and left central incisor areas



Fig. 6 Maxillary right central incisor served as an abutment to support the interim prosthesis

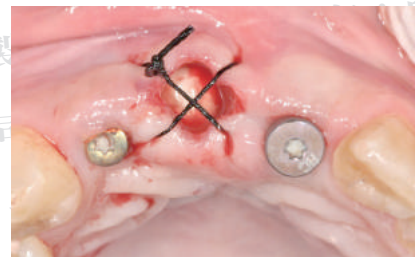


Fig. 7 Clinical view of maxillary right incisors after decoronation

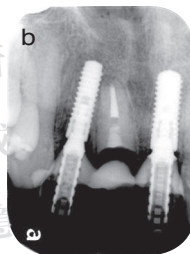


Fig. 8 Delivery of implant-supported interim prosthesis. (a) clinical view, (b) periapical radiograph



Fig. 9 Complete coverage of soft tissue at pontic site 3 months after root submergence



Fig. 10 Delivery of implant-supported screw-retained prosthesis (a) clinical view, (b) frontal view, (c) occlusal view, (d) lateral view

lateral and left central incisor were extracted (Fig. 4). After wound healing for 6 weeks, two implants (Bone level implant, SLA, Straumann, Switzerland) were placed at the site of the previous extraction areas (ϕ 3.3 mm X 12 mm for #7 site, ϕ 4.1 mm X 12 mm for #9 site), and time was then allowed for osseointegration (Fig. 5). To avoid the embarrassment of missing teeth during the healing period, the maxillary right central incisor was used as a temporary abutment to support the interim prosthesis after extraction of the maxillary right lateral and left central incisors (Fig. 6).

During the second-stage surgery, an open tray impression was taken with polyvinylsiloxane impression material (Aquasil, Dentsply, Germany). The implant-supported interim prosthesis was then fabricated with a bis-acryl composite resin by the indirect method. When

the interim prosthesis was ready, the maxillary right central incisor was decoronated to about 2 mm subgingivally and filled with glass ionomer cement on the top of the root surface (Fig. 7). The root was allowed to undergo secondary wound healing without an additional soft tissue graft. At the same appointment, the implant-supported interim prosthesis was delivered. The fitness of the implant-supported interim prosthesis was checked by taking a periapical radiograph (Fig. 8). The bottom part of the pontic area on the interim prosthesis was relieved in order to allow space for the growth of adjacent soft tissue. The ovate pontic form started to mold when the root was covered by soft tissue after 2 weeks. Follow-up appointments were arranged on a monthly basis. The patient was instructed on how to maintain oral hygiene, especially for the pontic area.

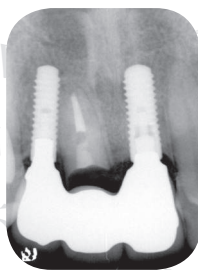


Fig. 11 Periapical radiograph when implant-supported prosthesis was delivered



Fig. 12 Follow up after one year. (a) frontal view, (b) occlusal view

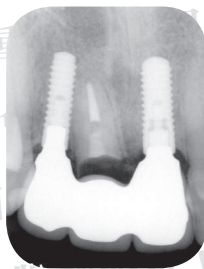


Fig. 13 Periapical radiograph check after one year

After a 3-month healing period, the pontic site development was stable, with the site completely covered by soft tissue (Fig. 9). The original ridge contour and arch form at the pontic area were preserved. A final impression was taken with a polyvinylsiloxane impression material (Aquasil, Dentsply, Germany). The screw-retained implant-supported prosthesis was then delivered (Fig. 10). A periapical radiograph was taken to check the fitness of the definitive prosthesis (Fig. 11). The pontic area was stable after 1-year of follow-up due to the use of the root submergence technique (Fig. 12, 13), and the patient was satisfied with the esthetic result.

Discussion

The root submergence technique can be used to preserve the arch form and ridge profile at the pontic site without the need for extensive periodontal surgery. Studies have indicated that both vital and non-vital roots can be submerged into the alveolar bone throughout the treatment period.¹⁵⁻¹⁷

Although the root submergence technique can maintain the gingival profile and alveolar contour, some complications may be cause for concern, including root caries, root resorption, periapical lesions, and gingival tissue perfora-

tion. In a 4-year clinical study, Von Wowern et al. showed soft tissue perforation in 11 out of 20 non-vital submerged roots under overdenture.¹⁸ Nevertheless, other studies have indicated that submerged roots were uneventful when these were retained underneath a tooth-supported prosthesis.^{12,19}

The keys to the success of the root submergence technique are complete soft tissue coverage, no direct occlusal load, and a lack of any periapical pathology. The crown of the tooth should be docorinated subgingivally and allowed sufficient time for complete soft tissue coverage. It is also important to note that the space should be left between the pontic area and the underlying mucosa for the first 2 weeks. In addition, the sharp edges of the roots also need to be reduced to avoid soft tissue perforation. The pontic site will start to mold when coverage of the soft tissue is completed. On the other hand, any occlusion of the pontic part should be adjusted for in order to eliminate direct loading on the submerged root. In addition, the root submergence technique should not be performed if the periapical pathology cannot be controlled in advance. Relatedly, the periapical conditions of the submerged root should be monitored throughout the follow-up period.

The retrievability of the prosthesis needs to be considered before using the root emergence technique in treatment, especially when dental implants are involved. Although the occurrence of complications involving the submerged root is not common under the conditions of well-controlled periapical pathology and occlusal loading, the importance of the preventive protocol cannot be overemphasized. In the current case, the screw-type implant prosthesis was chosen for reasons of retrievability. If unexpected complications of the emergence root were to have happened during

the follow-up period, the prosthesis could have been relatively easily to allow for periodontal surgery.

Summary

The root submergence technique can be used to preserve the height and width of the alveolar ridge. The present case report described how to develop the pontic site for an implant-supported prosthesis by using this technique. Due to the retention of the root, the original ridge profile can be maintained without further bone resorption. Also, acceptable esthetic results in the pontic area can be achieved without extensive surgical intervention.

References

- 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.
- Buser D, Dura K, Belser U, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. I. Surgical procedure in the maxilla. *Int J Periodontics Restorative Dent* 1993;13:29-45.
- Simion M, Baldoni M, Rossi P, Zaffe D. A Comparative study of the effectiveness of e-PTFE membranes with and without early exposure during the healing period. *Int J Periodontics Restorative Dent* 1994;14:167-80.
- Buser D, Dura K, Belser U, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. II. Surgical procedure in the mandible. *Int J Periodontics Restorative Dent* 1995;15:11-29.
- Grunder U. Crestal ridge changes when placing implants at the time of tooth extraction with and without soft tissue augmentation after a healing period of 6 months: report of 24 consecutive cases. *Int J Periodontics Restorative Dent* 2011;31:9-17.
- Nevins M, Camelo M, De Paoli S, Friedland B, Schenk RK, Parma-Benfenati S, et al. A study of the fate of the buccal wall of extraction sockets of teeth with prominent roots. *Int J Periodontics Restorative Dent* 2006;26:19-29.
- Darby I, Chen ST, Buser D. Ridge preservation techniques for implant therapy. *Int J Oral Maxillofac Implants* 2009;24(Suppl):260-71.
- Kan JYK, Rungcharassaeng K, Lozada J. Immediate placement and provisionalization of maxillary anterior single implants: 1-year prospective study. *Int J Oral Maxillofac Implants* 2003;18:31-9.
- Miller PA. complete dentures supported by natural teeth. *J Prosthet Dent* 1958;8:924-8.
- Morrow RM, Fedman EE, Rudd KD, Trovillion HM. Tooth-supported complete dentures: an approach to preventive prosthodontics. *J Prosthet Dent* 1969;21:513-22.
- O'Neal R, Gound T, Levin MP, del Rio BCE. Submergence of roots for alveolar bone preservation. I. Endodontically treated roots. *Oral Surg Oral Med Oral Pathol* 1978;45:803-10.
- Harper KA. Submerging an endodontically treated root to preserve the alveolar ridge under a bridge. A case report. *Dent Update* 2002;29:200-3.
- Salama M, Ishikawa T, Salama H, Funato A, Garber D. Advantages of the root submergence technique for pontic site development in the esthetic implant therapy. *Int J Periodontics Restorative Dent* 2007;27:521-7.
- Comut A, Mehra M, Saito H. Pontic site development with a root submergence technique for a screw-retained prosthesis in the anterior maxilla. *J Prosthet Dent* 2013;110:337-43.
- Garver DG, Fenster RK, Baker RD, Johnson DL. Vital root retention in humans: A preliminary report. *J Prosthet Dent* 1978;40:23-8.
- Garver DG, Fenster RK. Vital root retention in humans: A final report. *J Prosthet Dent* 1980;43:368-73.
- Welker WA, Jividen GJ, Kramer DC. Preventive prosthodontics-Mucosal coverage of the roots. *J Prosthet Dent* 1978;40:619-21.
- Von Wowern N, Winther S. Submergence of roots for alveolar ridge preservation. A failure (4-year follow-up study). *Int J Oral Surg* 1981;10:247-50.
- Rodd HD, Davidson LE, Livesey S, Cooke ME. Survival of intentionally retained permanent incisors roots following crown root fractures in children. *Dent Traumatol* 2002;18:92-7.