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CASE REPORT

Immediate provisional restoration of a single-tooth implant in the esthetic zone: A case report 單顆植體立即性暫時贖復於美觀區的應用—病例報告

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植體立即性贖復;
植體周圍美觀

Abstract Immediate implant restoration of single implants may demonstrate a positive effect on peri-implant soft tissue. Placement of a provisional restoration following implant surgery can create soft tissue contours that resemble normal gingival topography before placement of the definitive prosthesis. This article describes a staged approach of the mandibular permanent right central incisor, which was congenital missing. The proper space for restoration of the missing incisor was created through orthodontic treatment. The scheduled implant site was reconstructed using autogenous bone harvested from the chin region. After a healing period of four months, an implant was installed with the connection of a fixed provisional crown to a prefabricated temporary abutment. The soft tissue around the implant healed according to the contours of the provisional restoration and the emergence profile was used to duplicate the definitive restoration. Peri-implant esthetics was achieved through the staged approach and immediate restoration of the implant.

摘要 單顆植體立即性贖復對植體周圍軟組織有正向的作用。在置放永久贖復物前，植牙手術後隨即製作的臨時贖復物可創造出近似自然牙牙齦形態的軟組織外形。本文敘述如何階段性的處理右下正中恆門齒先天缺失伴隨齒槽骨缺損之病例。先經由矯正治療創造適當的贖復空間給先天缺失的下顎門齒。預計放置植體處的無牙嵴缺損以從下頷取得的自體骨做重建。經四個月的癒合

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期，置入人工植體後隨即接上預製的暫時支台柱及固定的臨時牙冠。調整臨時贗復物的外形來塑形植體周圍軟組織，並複製其萌出外形以製作最終贗復物。植體周圍美觀經此階段性的處理與植體立即性贗復而達成。

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Introduction

Traditional dental implant treatment usually requires an extended period for tissue healing and maturation before completion of the restoration. During the healing period, provisional treatment can be a challenge for the patient and the dentist, especially in the esthetic zone. Objectively, the esthetic zone is defined as any dentoalveolar segment that is visible on full smile. Subjectively, the esthetic zone can be defined as any dentoalveolar area of esthetic importance to a patient. With the rapid development of implant dentistry, new approaches aim to shorten the overall treatment time that have been proposed, such as immediate implant placement and immediate implant restoration following implant placement. The benefits of immediate implant restoration are optimized gingival form before definitive restorations, better clinical efficiency, fewer surgical interventions, and shortened treatment time.

Many studies have confirmed that immediate implant restoration shows similar success rates to a two-stage conventional approach and have reported short-term success rates between 96% and 100% [1–7]. Factors essential to success of immediate restoration include initial implant stability in good quality bone, surgical technique, and host- and occlusal-related factors [8–10].

The purpose of this report was to present a staged approach of the congenitally missing mandibular incisor with orthodontic treatment, ridge augmentation, and implant therapy. The single-tooth implant successfully replaced the missing incisor, both functionally and esthetically. The immediate implant restoration eliminates the period necessary for soft tissue healing and contouring because healing occurred concurrently with implant osseointegration. A detailed treatment process was also described.

Case presentation

A 32-year-old male presented with congenital missing of the mandibular permanent right central incisor and prolonged

retention of the deciduous incisor. According to his statement, he had no systemic disease or drug allergy history. The patient had a Class I, bimaxillary protrusive malocclusion. The clinical examination demonstrated that the mandibular deciduous right central incisor displayed short clinical crown with Grade I tooth mobility. A panoramic radiograph revealed the presence of a diminutive mandibular deciduous right central incisor and a horizontally impacted mandibular left third molar (Fig. 1).

The treatment plan included extraction of four first premolars and a dental implant replacement of the congenitally missing mandibular permanent incisor. At the finishing stage of orthodontic treatment, the proper space for restoration of the missing mandibular permanent incisor was created. The existing bone of the mandibular deciduous right central incisor was reevaluated by bone sounding with a periodontal probe. Deep bone sounding depths of 5–6 mm at the labial aspects and a labial concavity were observed. Immediate implant placement in this case may be risky and esthetically challenging. Therefore, the extraction of the mandibular deciduous right central incisor and socket preservation were considered. The tooth was atraumatically removed with a Periosteal Elevator (Nobel Biocare, Yorba Linda, CA, USA), which preserved the gingival and osseous architecture. A periodontal probe was used following tooth extraction to verify the integrity of the bony plate, and a 6-mm labial bone dehiscence was noted. The socket was preserved with bovine-derived xenograft (Bio-Oss®; Geistlich, Wolhusen, Switzerland) and a resorbable collagen membrane (BioMend Extend™; Sulzer Calcitek, Carlsbad, CA, USA). Primary closure was achieved with a coronally advanced flap (Fig. 2).

Five months after the socket preservation of the mandibular deciduous right central incisor, the designed implant site was reevaluated. Occlusal view of the edentulous ridge showed collapse of the labial and lingual gingival contours. Therefore, the bone augmentation procedure before implant placement was scheduled. After flap reflection, the labial and coronal defects of the scheduled implant site were reconstructed using autogenous bone harvested from the chin region. A nonresorbable

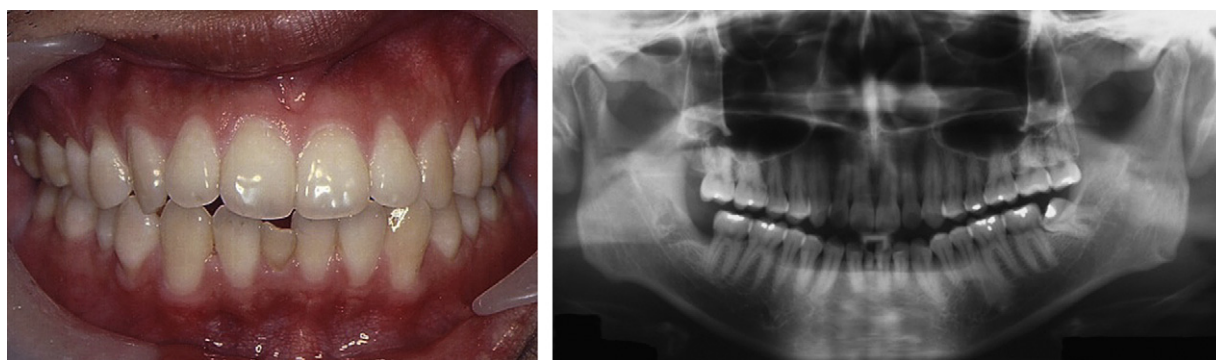


Figure 1. Clinical picture (left) and panorex (right) showed congenitally missing tooth No. 41.



Figure 2. Socket of tooth No. 81 after extraction (left) and socket preservation (right).

membrane (Gore-Tex[®], W.L. Gore and Associates, UK) was used and secured into place with two fixation nails. Tension-free primary closure of the wound was achieved through proper release of the flap (Fig. 3).

Four months following the bone augmentation, the recipient site was developed into proper contours for implant placement. A dental implant (XIVE[®]; Dentsply/Friadent, Mannheim, Germany) was installed into the prepared site with an insertion torque of 35 Ncm and a prefabricated temporary abutment (XIVE[®] TempBase[™]; Dentsply/Friadent, Mannheim, Germany) was connected to the fixture. Then a provisional acrylic resin crown was boned to the temporary abutment and adjusted (Fig. 4). The soft tissue was allowed to heal for approximately five months around the temporary restoration to accommodate sculpting and to allow for proper maturation of this tissue before final restoration. Five months after the immediate provisionalization, when the soft tissues had been esthetically sculpted and shaped, a final impression was taken and a zirconium abutment was made. An all-ceramic crown was delivered and cemented (Fig. 5). The three-year follow-up showed that the gingival architecture maintained the form as the definitive implant-supported crown was just delivered. Radiographic examination revealed the stable marginal bone level. The peri-implant esthetics was achieved and satisfied the patient's functional and esthetic expectations (Fig. 6).

Discussion

An important issue in tooth replacement is to reestablish normal form and architecture of the hard and soft tissues

before implant placement. This is especially challenging in the esthetic zone, where the replacement of a missing tooth must not only function but should also be esthetically harmonious with the contours of the adjacent natural dentition. In this case report, the site development before implant placement appeared to be critical to long-term stability and esthetics of the gingival tissues [11,12].

It is difficult to predict how sites will heal after socket preservation. Some sockets will heal without much resorption, whereas others will lose a lot of hard and soft tissue [13]. In this case presented, the Bio-Oss[®] particles were used as an osteoconductive material and for space maintenance beneath the membrane. This method has been shown to be effective for bone regeneration in the treatment of atrophic edentulous ridges [14]. Nevertheless, Fugazzotto [15] used Bio-Oss[®] with resorbable and non-resorbable membranes in guided bone regeneration and found that significant buccolingual ridge collapse was noted on reentry. Similarly in this case, the Bio-Oss[®] granules were not radiographically visible in the grafted site five months after the socket preservation and the edentulous ridge was still atrophic.

Autogenous bone is thought of as the "gold standard" among various grafting materials [16,17]. In this case, the nonresorbable membrane was used to prevent the ingrowth of gingival epithelium and connective tissue from the wound [18,19]. A healing period of four months allowed appropriate remodeling of the grafted autogenous bone without massive resorption [20,21]. Adequate bone volume was created for subsequent implant placement. The nonresorbable membrane could be removed simultaneously to implant insertion without additional reentry. However, postsurgery, the patient

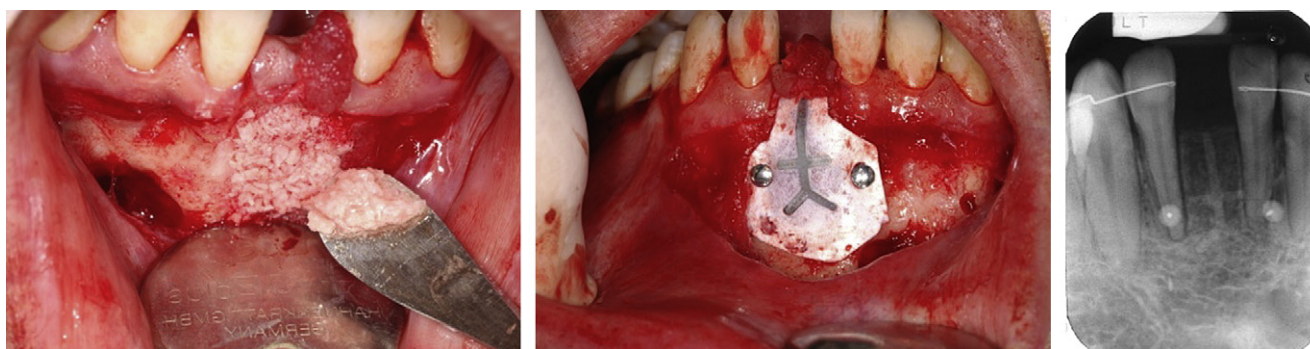


Figure 3. Bone augmentation using chin bone (left) and a nonresorbable membrane (middle) and periapical film (right).



Figure 4. Implant placement and immediate provisionalization (left) and periapical film (right).

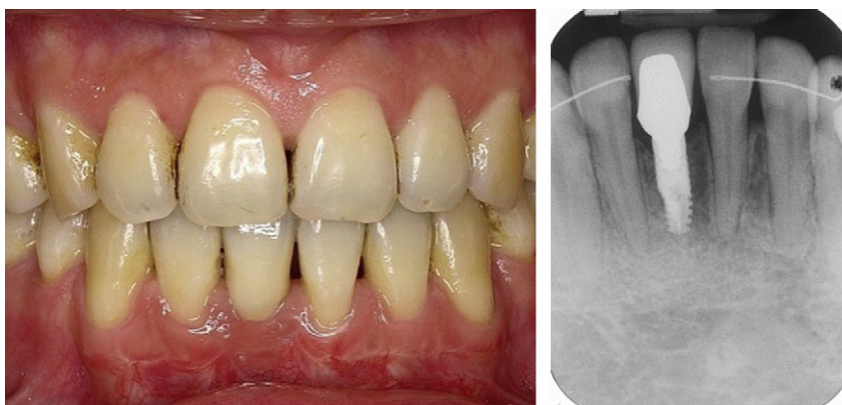


Figure 5. A zirconium abutment and an all-ceramic crown were delivered and cemented (left) and periapical film (right).

may experience discomfort in the donor site and they must be informed before performing the procedures.

One of the main prerequisites for immediate loading is sufficient initial implant stability. Different standard methods, such as the insertion torque, the Periotest® (Medizintechnik Gulden, Modautal, Germany) and resonance frequency analysis have been used to evaluate the implant stability [22,23]. Immediate provisionalization has been suggested when optimal primary stability is reflected by a placement torque greater than 30 Ncm or resonance

frequency analysis demonstrated an implant stability quotient greater than 60 [3,24].

Implant-supported provisional restorations have been demonstrated to be an effective means to temporarily restore single implants following implant installation. There are many advantages of immediate provisionalization of implants, including the ability to immediately evaluate implant positioning; the desired emergence profile can be generated immediately to allow the soft tissue to heal to its designed contours; additional surgical operation or other

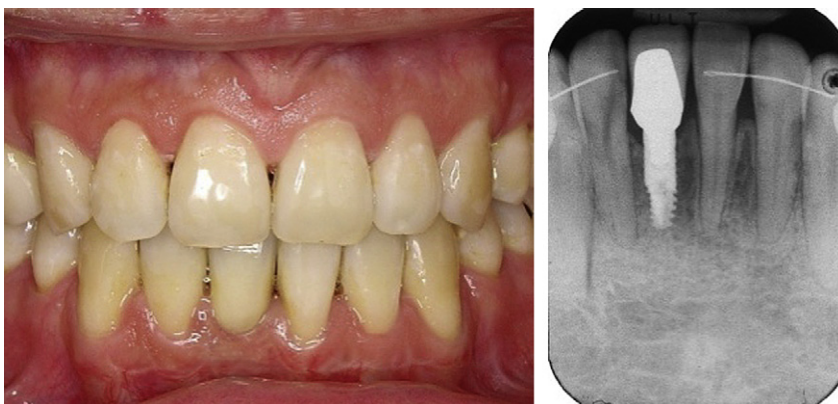


Figure 6. The three-year follow-up (left) and periapical film (right).

soft tissue manipulation may be avoided; being a diagnostic tool to confirm esthetics, contours, accessibility for oral hygiene; and can be used to duplicate the definitive restoration [25–27].

In this case, the deficiency in the mandibular central incisor region was reconstructed using a staged approach of site development. Immediate implant restoration of the single implant aided the contouring of peri-implant soft tissue and satisfied the patient. With precise protocols and meticulous techniques, immediate implant restoration may reduce treatment time and maximize esthetic outcomes.

References

- [1] Wohrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization: fourteen consecutive case reports. *Pract Periodontics Aesthet Dent* 1998;10:1107–14.
- [2] Proussaefs P, Kan J, Lozada J, Kleinman A, Farnos A. Effects of immediate loading with threaded hydroxyapatite-coated root-form implants on single premolar replacements: a preliminary report. *Int J Oral Maxillofac Implants* 2002;17:567–72.
- [3] Lorenzoni M, Pertl C, Zhang K, Wimmer G, Wegscheider WA, et al. Immediate loading of single-tooth implants in the anterior maxilla. Preliminary results after one year. *Clin Oral Implants Res* 2003;14:180–7.
- [4] 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.
- [5] Norton MR. A short-term clinical evaluation of immediately restored maxillary TiOblast single-tooth implants. *Int J Oral Maxillofac Implants* 2004;19:274–81.
- [6] Cornelini R, Cangini F, Covani U, Wilson Jr TG. Immediate restoration of implants placed into fresh extraction sockets for single-tooth replacement: a prospective clinical study. *Int J Periodontics Restorative Dent* 2005;25:439–47.
- [7] Mijiritsky E, Mardinger O, Mazor Z, Chaushu G. Immediate provisionalization of single-tooth implants in fresh-extraction sites at the maxillary esthetic zone: up to 6 years of follow-up. *Implant Dent* 2009;18:326–33.
- [8] Gapski R, Wang HL, Mascarenhas P, Lang NP. Critical review of immediate implant loading. *Clin Oral Implants Res* 2003;14:515–27.
- [9] Ottoni JM, Oliveira ZF, Mansini R, Cabral AM. Correlation between placement torque and survival of single-tooth implants. *Int J Oral Maxillofac Implants* 2005;20:769–76.
- [10] Del Fabbro M, Testori T, Francetti L, Taschieri S, Weinstein R. Systematic review of survival rates for immediately loaded dental implants. *Int J Periodontics Restorative Dent* 2006;26:249–63.
- [11] Kan JYK, Rungcharassaeng K. Site development for anterior single implant esthetics: the dentulous site. *Compend Contin Educ Dent* 2001;22:221–31.
- [12] Covani U, Bortolaia C, Barone A, Sbordone L. Bucco-lingual crestal bone changes after immediate and delayed implant placement. *J Periodontol* 2004;75:1605–12.
- [13] Darby I, Chen S, De Poi R. Ridge preservation: what is it and when should it be considered. *Aust Dent J* 2008;53:11–21.
- [14] Fugazzotto PA. Report of 302 consecutive ridge augmentation procedures. Technical consideration and clinical results. *Int J Oral Maxillofac Implants* 1998;13:358–68.
- [15] Fugazzotto PA. GBR using bovine bone matrix and resorbable and nonresorbable membranes. Part 1: histologic results. *Int J Periodontics Restorative Dent* 2003;23:361–9.
- [16] Becker W, Becker BE, Caffesse R. A comparison of demineralized freeze-dried bone and autologous bone to induce bone formation in human extraction sockets. *J Periodontol* 1994;65:1128–33.
- [17] Froum S, Cho SC, Rosenberg E, Rohrer M, Tarnow D. Histological comparison of healing extraction sockets implanted with bioactive glass or demineralized freeze-dried bone allograft: a pilot study. *J Periodontol* 2002;73:94–102.
- [18] Hämmerle CH, Olah AJ, Schmid J, Flückiger L, Gogolewski S, Winkler JR, et al. The biological effect of natural bone mineral on bone neof ormation on the rabbit skull. *Clin Oral Implants Res* 1997;8:198–207.
- [19] Pripatanont P, Nuntanarant T, Chungpanich S. Two uncommon uses of Bio-Oss for GTR and ridge augmentation following extractions: two case reports. *Int J Periodontics Restorative Dent* 2002;22:279–85.
- [20] Barteck BK. Extraction site reconstruction for alveolar ridge preservation. Part 1: rationale and materials selection. *J Oral Implantol* 2001;27:187–93.
- [21] Barteck BK. Extraction site reconstruction for alveolar ridge preservation. Part 2: membrane-assisted surgical technique. *J Oral Implantol* 2001;27:194–7.
- [22] Olive J, Aparicio C. The Periostest method as a measure of osseointegrated oral implant stability. *Int J Oral Maxillofac Implants* 1990;5:390–400.
- [23] Romanos GE. Bone quality and the immediate loading of implants-critical aspects based on literature, research, and clinical experience. *Implant Dent* 2009;18:203–9.
- [24] Crespi R, Cappare P, Gherlone E, Romanos GE. Immediate occlusal loading of implants placed in fresh sockets after tooth extraction. *Int J Oral Maxillofac Implants* 2007;22:955–62.
- [25] Biggs WF, Litvak Jr AL. Immediate provisional restorations to aid in gingival healing and optimal contours for implant patients. *J Prosthet Dent* 2001;86:177–80.
- [26] Priest G. Esthetic potential of single-implant provisional restorations: selection criteria of available alternatives. *J Esthet Restor Dent* 2006;18:326–39.
- [27] David R. Provisional restoration for an osseointegrated single maxillary anterior implant. *J Can Dent Assoc* 2008;74:609–12.