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Reconstruction of the anterior maxilla with implants using customized zirconia abutments and all-ceramic crowns: a clinical case report

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The placement of dental implants in the anterior maxilla is challenging for clinicians due to patients' high esthetic demands and the difficult management of peri-implant tissues. Peri-implant tissue complications seriously affect the critical esthetics of anterior implants. Therefore, preventative measures should be considered during implant treatment. In this case, implant placement was performed in #11 immediately after the patient lost #11 due to trauma because the patient had sufficient bone height and thickness and no pathologic conditions. One-mm labial and lingual distances between the implant andthe bone were observed with no sign of dehiscences, and GBR or tissue grafts were not required. The final impression, which was taken 5 months after the placement, confirmed the formation of interdental papillae and labial gingiva. The final restoration with a zirconia custom abutment provided successful esthetic results.
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Key Words: All ceramics, Customized impression coping, Customized zirconia abutment, Implant

INTRODUCTION

Dental implants have become increasingly important since Dr. Per-Ingvar Brånemark introduced them to dentistry. However, the management of peri-implant tissues is problematic due to the less predictable shape of soft tissue compared with periodontal tissues and the more rapid apical progression of inflammation[1]. These complications seriously affect the critical esthetics of anterior implants. Therefore, preventative measures should be considered during implant treatment. This study reports a patient who was successfully treated, both esthetically and functionally, with an anterior maxilla implant.

1. Ideal esthetic implant placement in the anterior maxilla

In order to achieve ideal esthetic implant placement, the buccolingual, mesiodistal, and apicocoronal positions relative to the implant platform must be considered. Spray reported that the facial bone thickness for the implant placement and the uncovering stage approached 1.8 to 2 mm, which reflected a significant decrease in bone loss[2]. Studies have shown that a 2.22-mm vertical bone loss occurs when the mesiodistal distance between the implants and the neighboring teeth is less than 1 mm. Vertical bone loss is reduced to less than 1 mm when a distance less than 2 mm is maintained[3]. In addition, Tarnow has reported a vertical bone loss of 1.04 mm per year when the mesiodistal distance between the implants and the neighboring teeth is less than 3 mm. If the distance is over 3 mm, the vertical bone loss is reduced by 0.54 mm per year[4]. Consequently, the mesiodistal distance should be maintained at a minimum of 2 mm between the implants and neighboring teeth and 3 mm between adjacent implants. For the apical positioning of the implant, Buser (2004) suggested that honoring the maxim of "as shallow as possible, as deep as necessary" helps to maintain the interplant crest height and provides support for peri-implant tissues[5]. If an implant is placed too deep, it invades the biologic width, which causes physiological marginal

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bone resorption that will lead to undesired soft tissue recession. Too shallow implant placements compromise the esthetic emergence profile of the restoration. Thus, the recommended position of the implant shoulder is 2～3 mm apical to the adjacent cementoenamel junction.

2. Critical gap (Jumping distance): distance between the implant surface and the adjacent bone

The critical gap is the distance between the implant surface and the adjacent bone that does not require additional treatment to achieve osseointegration. Botticelli and colleagues (2003) have reported that the critical gap of implants that were designed with a Sandblasting with Large grit and Acid etching surface is 1.25 mm. However, they revised the jumping distance to 2.25 mm in 2004[6,7]. A bone-to-implant distance that exceeds the critical gap usually requires Guided Bone Regeneration (GBR) and barrier membranes.

3. The relationship between vertical alveolar bone height and implant esthetics

Tarnow (1992) reported in a well-known study that the presence of interproximal papillae can be correlated with the distance from the base of the contact area to the crest of the bone: papillae were present almost 100% of the time when the distance from the contact point to the crest of the bone was 5 mm or less.8 When the distance was 6 mm, the papillae were present 56% of the time. Therefore, these results suggest that proper vertical bone height is more important for complete papilla formation than the ability to modify the contact point.

Grunder (2000) has suggested that papilla regeneration in implants between natural teeth is determined by the bone height of the natural teeth[9]. Although invading the biologic width will lead to circumferential bone loss of the implant after placement, the papillae will be present in cases in which the distances between the contact points and the crests of the implants are more than 7 mm. By maintaining distances of more than 2 mm between the implants and the natural teeth, the vertical bone height of the natural teeth will not change, which then prevents the distance from the contact point to the crest of the implant from exceeding 5 mm. Thus, the key to natural papilla regeneration in anterior implants is to preserve the alveolar bone of the natural teeth.

CASE REPORT

A 19-year-old male with no significant medical history presented to the clinic after losing #21 due to trauma. Tooth replantation was not an option because of the absence of #21. The treatment options for replacing the missing tooth, which included implant placement and a 3-unit bridge, were discussed with the patient. The patient chose implant placement and restoration.(Fig. 1, 2)

A cone beam computed tomography scan, which was used to plan for immediate implant placement, revealed enough vertical bone height and buccolingual bone thickness for the placement. Proper initial stability was expected because enough alveolar bone remained below the extraction socket. Consequently, immediate implantation was planned.(Fig. 3) Sufficient buccolingual bone thickness around the socket allowed for esthetic implant treatment without requiring additional GBR or tissue grafts. A round bur was used to ensure palatal orientation of the

Fig. 1. The initial radiograph.

Fig. 2. Clinical view of initial examination (A) Frontal view. (B) Occlusal view.

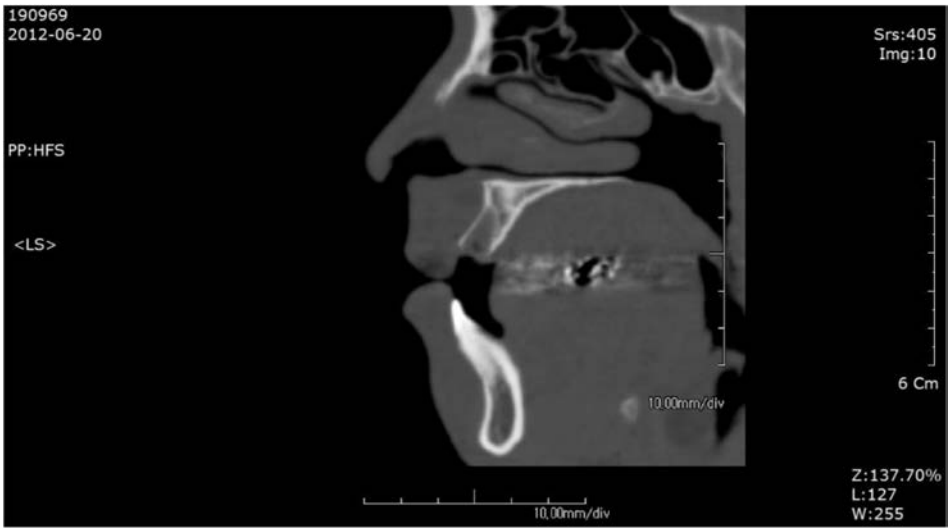

Fig. 3. CT view of initial examination.

Fig. 4. Implant installation.

implant in order to obtain proper load direction and initial stability. During the initial drilling, the palatal orientation of the implant was maintained in order to preserve sufficient labial bone thickness.A self-tapping tapered implant with a diameter of 4.3 mm and a length of 12 mm (Implantium, Dentium Co., Ltd., Seoul, South Korea) was placed 2.5 mm apical to the adjacent cementoenamel junction in order to obtain an ideal emergence profile in the final restoration and preserve the biologic width. The insertion torque was over 25 Ncm, which was adequate.(Fig. 4) Both of the labial and lingual gaps between the implant and the bone were 1 mm. Dehiscences were not observed. These observations led to the immediate connection of a temporary abutment, and tissue grafts or GBR were not required.(Fig. 5, 6)

A provisional crown was placed directly after the soft tissue management and temporary abutment connection steps.(Fig. 7) The immediate postoperative period was uneventful, and the patient returned after 5 months for the final restoration. Plaque deposition was observed around the pontic, which caused mild gingival inflammation. However, the provisional crown resulted in good formation of the interdental papillae and labial gingiva, which allowed for the creation of a final impression.(Fig. 8) The zirconia patient-customized abutment (Zirconia MyPLANT, RaphaBio Co., Ltd., Seoul, South Korea) was positioned and tightened with a final torque of 30 Ncm.

The ceramic crowns for #11 and #21 (IPS e.max Press, Ivoclar Vivadent AG, Schaan, Liechtenstein) were cemented with resin cement (RelyX Unicem, 3M, St. Paul, MN, USA).(Fig. 9) Although scar tissue remained in the site of the labial frenectomy, interdental papillae were present in 100% of the embrasure, and the labial gingival line was in harmony with the adjacent teeth. The color and shape of the final restoration was esthetic and natural. Therefore, the patient was satisfied with the esthetic and functional aspects.

The zirconia patient-specific abutment and crown were chosen to improve the esthetics.(Fig. 9, 10). Excellent final esthetic results and good oral hygiene were observed in clinical photos, cone beam computed tomography scans, and radiographs 2 months after the abutment and crown placement.

Fig. 5. Healing abutment connection.

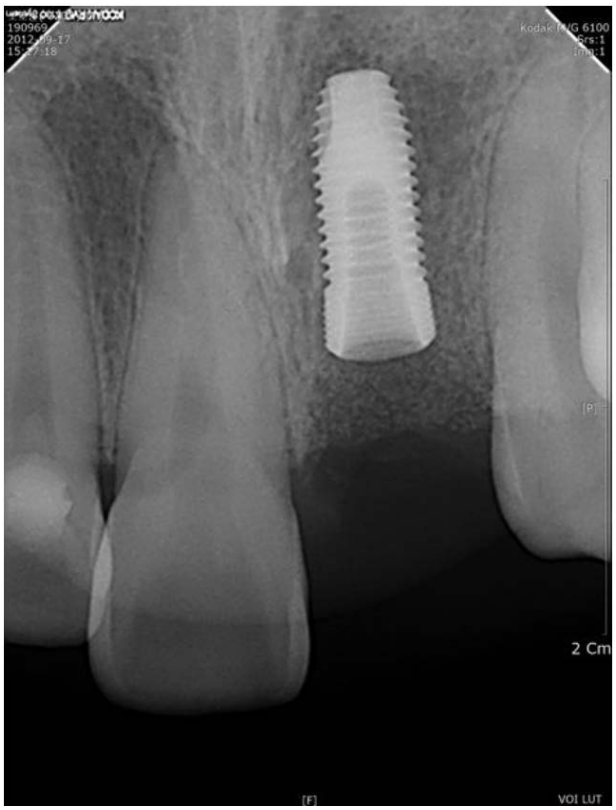

Fig. 6. Periapical radiograph taken after implantation.

Fig. 7. Provisional restoration setting.

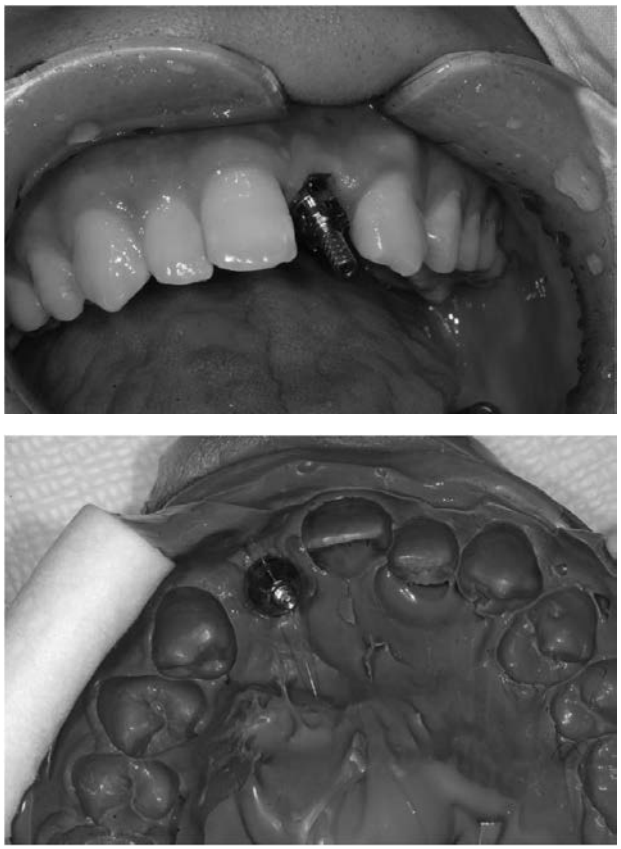

Fig. 8. Impression taking after 5 months. (A) impression coping connection. (B) Lab analog connection.

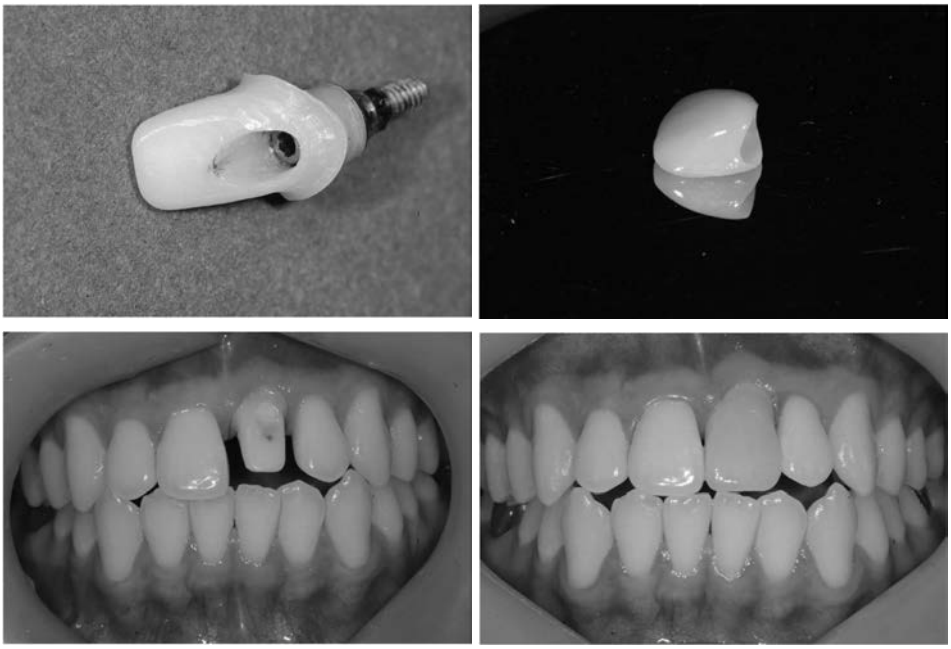

Fig. 9. Clinical photo of final restoration. (A) zironia Abutment connection (B) Final prosthesis. (C) Frontal view taken after zironia abutment delivery (D) final prothedsis delivery.

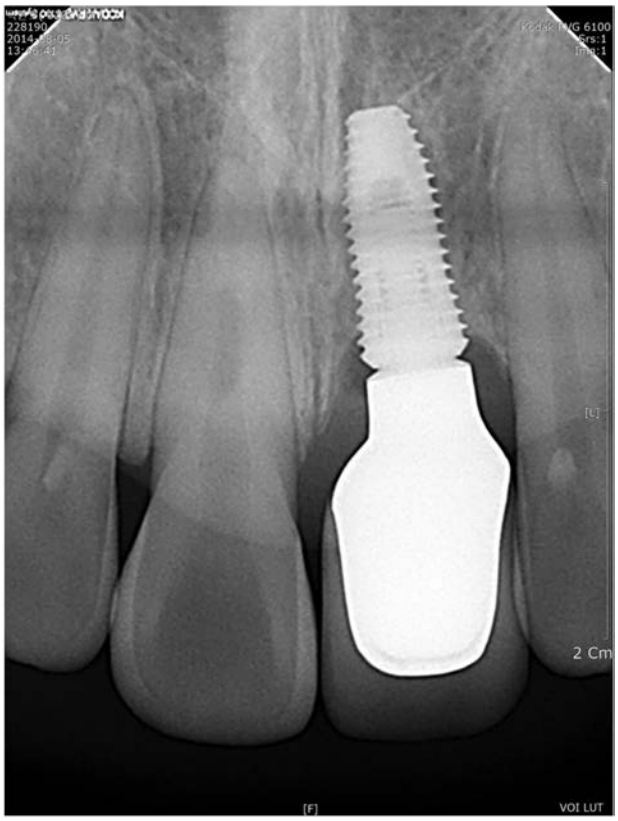

Fig. 10. Periapical radiograph taken after final restoration delivery.

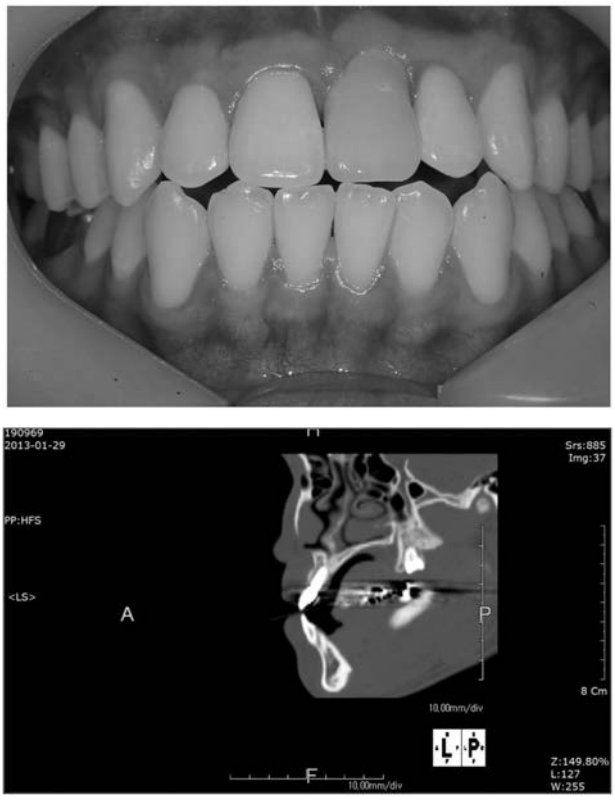

Fig. 11. Intraoral photograph and CT view of 2months after final restoration delivery.

DISCUSSION

Many studies have examined customized implant abutments, which have mainly been used for compromised implant placements and apically deep placements[10-12]. Custom abutments are increasingly used in both anterior and posterior implants because they offer a patient-specific design that sculpts the gingiva in order to form ideal

contours and emergence profiles.

Glauser has reported that no abutment fractures occurred in their implant-supported single-tooth reconstructions for a median observation period of 49.2 months[13]. In addition, Yildrim reported that no abutment fractures occurred in any of their ceramic restoration cases for over 5 years[14].

By fabricating a zirconia custom abutment, we were able to preserve the gingival contour that was formed during the healing phase in this case. The results of this study suggested that zirconia customized abutments provide functionally and esthetically satisfying results. A limitation of this study that should be noted was the short period of observation.

CONCLUSION

In this case, implant placement was performed in #11 immediately after the patient lost #11 due to trauma because the patient had sufficient bone height and thickness and no pathologic conditions. One-mm labial and lingual distances between the implant and the bone were observed with no sign of dehiscences, and GBR or tissue grafts were not required. The final impression, which was taken 5 months after the placement, confirmed the formation of interdental papillae and labial gingiva. The final restoration with a zirconia custom abutment provided successful esthetic results.

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