Novel Approach to Managing Malsequenced and Malpositioned Immediately Placed Implants in the Esthetic Zone

Esthetic implant therapy can be challenging in the anterior maxilla, and meticulous treatment is often required to deliver optimal esthetics. Close collaboration between surgical and prosthetic team members using the novel approach of prosthetic crown lengthening helped camouflage a shallow implant platform location, providing the proper gingival frame for esthetic restorations. This case report presents an interdisciplinary approach that included ridge augmentation, second-stage crown lengthening, and prosthetic soft tissue manipulation to address an implant placed too shallow in the alveolus of an extraction socket.


Immediately placed implants in the esthetic zone are often a challenging treatment modality to deliver optimal esthetics and require precise diagnosis, flawless planning, and exact execution. When any of these are incomplete or not ideal, the outcome will be compromised. Historically, immediately placed implants were advocated to reduce treatment time, retain bone, and decrease the number of surgeries required. In spite of these advantages, there are a number of limitations to immediate implant placement in the esthetic zone. These include insufficient bone volume, soft tissue deficiency in type and volume, incorrect angulation, and an improperly positioned implant platform. This case report presents prosthetic crown lengthening as a novel approach to address an implant platform placed too shallow in an extraction socket.

Case report

A healthy 60-year-old woman recently completed a posterior reconstruction and desired esthetic improvement of her anterior dentition. The patient presented to the Georgia Regents University Center for Esthetic and Implant Dentistry with provisionalized crowns on the maxillary central incisors where the left central incisor was a dental implant.
An intraoral examination revealed short clinical crowns, a tooth size discrepancy, a lack of gingival harmony, and buccal alveolar deficiency (Fig 1). Diagnostic records, including photographs, diagnostic impressions, and facebow records, were collected. Instructions were given to the lab technician for fabrication of a wax-up with the desired number of teeth to be restored and tooth size and shape. This wax-up was duplicated and transferred to the patient's mouth to evaluate proportion, display, and length of the proposed restorations. Following this consultation, it was decided that tooth size needed to be adjusted. It was determined that the maxillary central incisors and right lateral incisor needed to be lengthened at the gingival margin. The wax-up was removed on the left central incisor and a North Carolina 12-mm periodontal probe was used to determine the location of the implant platform, which was found to be 3 mm from the gingival margin (Fig 2a). When the desired prostheses was evaluated, it was noted that the gingival margin on the left central incisor needed to be moved 2.5 mm apically (Fig 2b).

A surgical treatment plan included osseous crown lengthening for the maxillary right central and lateral incisors and soft tissue volume augmentation (AlloDerm, BioHorizons) for the left central incisor to resist pressure and avoid recession for the planned prosthetic crown lengthening. In addition, a bone graft was planned to address the buccal alveolar deficiency. The surgical treatment plan was reviewed, and the patient consented to the proposed treatment.

Case management and clinical outcomes

Local anesthesia was administered, infiltrating buccally, and a sulcular incision was made from canine to canine. A full-thickness mucoperiosteal flap was elevated, and the osseous ridge was visualized (Fig 2c). The original temporary abutment and provisional crown on the implant at the site of the left central incisor was removed. A new temporary abutment was placed along with the surgical guide to verify the desired tooth length of the implant crown. However, this was not possible for the left central incisor because it would have exposed the implant platform and the buccal surface of the implant, creating an even more esthetic outcome. The new temporary abutment was removed and the old temporary abutment was placed on the implant. With the guide in place, 3 mm of osseous resection was performed on the buccal surface using rotary and hand instrumentation. A 6 × 18-mm piece of hydrated acellular dermal matrix and single sling

Fig 1 Initial presentation. (a) Facial view with provisionals on the maxillary right central incisor and the implant at the site of the maxillary left central incisor. (b) Occlusal view. Note the buccal alveolar deficiency at the maxillary left central incisor. (c) Radiograph at initial presentation.
sutures (4-0 vicryl) were employed to adapt the dermal matrix to the maxillary left lateral incisor and canine (Fig 3a). Hydrated deproteinized bovine matrix (Bio-Oss, Osteohealth) was placed over the implant fenestration at the left central incisor implant site (Fig 3b). The sling suture was then continued on the central incisors and the right lateral incisor (Fig 3b). The gingival flap was sutured using sling sutures and simple interrupted sutures. The patient was given amoxicillin 500 mg every 8 hours for 1 week and ibuprofen 800 mg every 6 hours for 6 days, hydrocodone 5 mg/500 mg every 6 hours as needed for pain, and chlorhexidine 0.12% mouthrinse with 15 mL twice daily for 2 weeks. The patient was instructed not to brush or floss her anterior dentition for 2 weeks and was placed on a soft diet. She returned for a 2-week postoperative visit, and sutures were removed at this appointment.

After 3 months of healing, the patient returned and the old temporary abutment and crown were removed. The patient was anesthetized. The prosthetic crown lengthening on the maxillary left central incisor was initiated (Fig 4). The new abutment and crown that was designed to match the mock-up was placed on the maxillary left central incisor implant. Compressing the augmented gingival tissues causes a localized ischemia and creates an environment that supports less gingival tissue, causing permanent loss of soft tissue volume and potential deformity. If contours are too convex, the soft tissue margins may be pushed too far apical and the implant platform may be exposed. After the new abutment and crown were placed, the soft tissue was blanched for more than 10 minutes.
It was determined that the prosthetic crown lengthening would be done over a series of appointments rather than at one time to avoid blanching that exceeded the soft tissue’s ability to withstand pressure. Reduction of the buccal and interproximal convexities on the abutment and crown were performed. Following 3 weeks of remodeling, the patient returned for a second adjustment (Fig 5). Acrylic was added to the temporary abutment and provisional to restore these to the full contour of the desired crown. The patient was then scheduled for a gingivectomy on the maxillary right central and lateral incisors. After the patient was anesthetized, the surgical guide was placed and a scalpel and an electrosurgical unit were used to remove the excess soft tissue on the maxillary right central and lateral incisors (Fig 6). After 2 weeks of healing the patient returned for final preparations of the maxillary right central and lat-
eral incisors and right lateral incisor. Impressions were taken of the soft tissue adjacent to the right central incisor, and the final prosthetic impressions were taken. The ceramist then designed a zirconia abutment to mimic the desired temporary abutment to support the soft tissue on the right central incisor implant (Fig 7). Following fabrication of the final porcelain-fused-to-zirconia restorations, they were bonded using resin cement (Fig 8). The patient returned for an examination 1 month following definitive restorations and 18 months after surgery. The 5-year follow up included a radiographic examination (Fig 9).

**Discussion**

This case involved a combination of high smile line, short clinical crowns, and a malpositioned immediately placed implant with deficient peri-implant soft tissue. This challenge, mainly resulting from incomplete planning and malsequenced
immediate implant placement, required a preliminary soft and hard tissue augmentation.

Originally, the patient was diagnosed with a nonrestorable maxillary left central incisor, leading to immediate implant placement. Advantages of immediate implant placement following tooth extraction, originally reported by Lazzara, include short healing time, reduced number of surgeries, and a relatively excellent esthetic outcome. However, some reports suggest that labial gingival recession may occur because of postoperative labial alveolar bone loss. Alveolar ridge alteration is inevitable following tooth extraction and can reach losses of 2.2 mm in width and 2.6 mm in height. Immediate implant placement is associated with greater vertical and horizontal alveolar resorption than delayed implant placement. Ideally, when implant placement is delayed, 2 mm of bone facial to the platform is required to prevent gingival recession and ensure a predictable outcome. The challenges involved in postextraction buccal alveolar bone loss and implant placement and the risk for future gingival recession in the esthetic zone have been a focal point for research in the last decade. An increased mucosal recession rate between 20% and 40% was reported in two systematic reviews of esthetic complications with immediate implants that mainly examined nonplatform-switching implants. Buser et al offered the early implant placement protocol, which may be coupled with guided bone regeneration to compensate for future tissue loss and ensure peri-implant tissue stability. This study compared buccal bone thickness around immediate and delayed placed implants and demonstrated that immediate implant placement carries a greater risk of gingival recession and bony dehiscences, requiring simultaneous augmentation procedures to avoid future esthetic compromise.

Different approaches to soft and hard tissue augmentation as well as immediate provisionalization have been proposed and analyzed to minimize the tissue alterations after immediate implant placement. Lee et al found an overall change of 0.08 mm from the external surface of the labial plate and the labial surface of the implant at 6 months of follow-up. Conclusions from this study indicated that alterations in the buccal alveolar plate were negligible after 6 months of follow-up when platform-switching design, lingual orientation of the implant, and bovine-derived particulate as a graft in the socket were used.

Tarnow et al also studied soft and hard tissue collapse with immediately placed implants. Their study found only an average change of 0.4 mm facial palatal dimensional reduction. In addition to avoiding flap elevation at the time of implant placement, they recommended grafting the residual labial gap and protecting it with a contoured healing abutment or provisional restoration. Lastly, Yoshino et al found after 1 year follow-up a mean facial gingival recession of −0.25 mm when immediate implant placement was combined with the use of subepithelial connective tissue grafts.

As the patient’s treatment plan developed, it was determined that increased length was needed to address the problems identified in the evaluation. The desired incisal edge position of the central incisors wasn’t indicated to be adjusted. However, to satisfy tooth size and proportion needs, lengthening the teeth by apical positioning of the gingival margins was indicated. For the maxillary right central and lateral incisors, a crown lengthening was planned. However, lengthening the left central incisor implant would require a more sophisticated approach. As an overcontoured crown and abutment were placed on the implant, the peri-implant soft tissue would be molded to the desired crown shape. Since the final position of the gingival margins on the left central incisor could not be predicted, the crown lengthening on the left central and lateral incisors was planned to be completed in two stages. The first step would involve osseous recontouring, and the second, resection of gingiva. This created harmony in the gingival margins of the adjacent teeth with the final gingival margins on the left central incisor. A one-stage definitive crown lengthening would lead to a compromised outcome when the final gingival margins are determined without respecting the peri-implant tissue health and final position. These potential compromised outcomes could include either an anterior gingival discrepancy or, worse yet, a gingival recession exposing the implant abutment on the left central incisor. However, with close collaboration between prosthetic
and surgical members of the team, a harmonious esthetic outcome was delivered that supported the long-term health of the peri-implant tissues. The additional volume gained could withstand future soft tissue manipulation indicated through esthetic crown lengthening that will exclusively be achieved by crown and abutment contour modification. Soft tissue thickness was achieved with acellular dermal matrix. The use of acellular dermal matrix has been shown to lead to an average vertical soft tissue volume of 4 mm. The advantages of using acellular dermal matrix are that the need for a second surgical site is excluded and that an unlimited number of defects can be treated at one time. Some of the limitations of acellular dermal matrix as opposed to subepithelial graft are that in the long term, over 5 years, acellular dermal matrix tends to shrink in volume and that an unlimited number of defects can be treated at one time. In hindsight, although no gingival recession was evident in long-term follow up (Fig 9), connective tissue grafts would be more predictive in the stability of soft tissue volume.

In 2008, Su et al defined the critical and subcritical areas of the abutment and crown contour to mold the soft tissue while developing the emergence profile. In this case, modifying the implant abutment and crown contour allowed alterations of critical and subcritical contour to be used to develop the soft tissue emergence profile. In cases where changing the shape of the crown is not desirable, only modifications of the subcritical contour are indicated. Customizing the shape and the contour improves the peri-implant frame and forms the emergence profile. Bichacho and Landsberg emphasized the cervical contouring concept, using a customized provisional restoration to reshape the soft tissue around implants. Caution should be taken to avoid contouring the facial subcritical contour beyond the range of physiologic tolerance. Exaggerated subcritical contouring will induce gingival edema and/or possible sinus tract formation. Ultimately, gingival recession may occur, which was expected in this case. The initial reaction to the applied pressure on the mucosa at insertion is of the ischemic type, causing so-called blanching of the peri-implant soft tissue that should disappear within 15 minutes if only mild contouring is performed. Waiting until the ischemic reaction disappears, confirming that blood perfusion has been reestablished, is recommended. Care was taken not to impinge on the interproximal tissue while altering the interproximal subcritical contour. It is important that this procedure is done under healthy gingival condition with optimal plaque control by the patient.

Although this patient had always had short clinical crowns, this wasn’t recognized. This oversight allowed for the implant to be placed with the implant platform 3 mm from the existing buccal gingival margins. Having the implant platform at this position dictated what would likely lead to short clinical crowns on her central incisors. Ideally, this patient’s treatment should have started with a comprehensive evaluation using a diagnostic wax-up to evaluate tooth size, proportion, and display. She would have had her anterior teeth lengthened first, followed by extraction and implant placement. Alternatively, the implant could have been positioned at the ideal crown margins at placement. Instead, it was necessary to use the technique of prosthetic crown lengthening to avoid esthetic compromise while exposing the implant platform.

Many factors contribute to a successful esthetic outcome in implant dentistry. In addition to proper tooth proportion, tooth display, incisal edge position, and profile and gingival contours, localized factors related to single-tooth replacement in the esthetic zone are critical. Correct tridimensional positioning of the implant platform and adequate soft and hard tissue volume are critical for success. Hard and soft tissue augmentation was completed in this case for two reasons: to restore the buccal alveolar contour and, more importantly, to increase tissue volume and make the tissue more resistant to the prosthetic pressure of the abutment and crown.

By adjusting the contours of the provisional crown over time, it was possible to change the gingival contours around the implant restoration and harmonize this with the natural dentition. Other options included removing the implant or submerging it while enhancing the pontic site under a fixed partial denture. The palatal positioning of the implant in this case allowed for restoration of the existing implant and provision of a natural emergence profile.
Conclusions

This case reinforces the significance of proper comprehensive esthetic analysis prior to initiation of treatment as well as the critical measures related to immediate implant placement and its timing in the overall esthetic treatment.

Acknowledgments

The authors would like to acknowledge Mr Viet Tran, Master Dental Ceramist, for the laboratory support and restorations. This work was supported by the Nobel Biocare/AU center for excellence. Drs Bingham, Pumphrey, Stern, and Britton report no conflicts of interests related to this case report. Dr. Chiche is a consultant with Kuraray-Noritake Co.

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