

Alveolar Ridge Augmentation using Subepithelial Connective Tissue Grafts: A Case report

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Abstract

Alveolar ridge deformity occurs frequently after teeth loss, leading to esthetic and functional compromises especially in the anterior maxilla. This case report demonstrates a two-step surgical ridge augmentation procedure using soft tissue grafts. A 42-year-old woman with Seibert Class III ridge deformity in the esthetic zone received plastic surgery using a subepithelial connective tissue graft harvested from the palate. The edentulous ridge healed with adequate buccolingual and apicocoronal contours. Fixed partial dentures were reconstructed with ovate pontic design to improve both functional and esthetic outcomes. Thus, the use of subepithelial connective tissue grafts is helpful in treating Seibert Class III ridge deformities.

Keywords: alveolar ridge augmentation, connective tissue graft, fixed partial denture, ovate pontic.

Introduction

Edentulous areas where fixed prostheses are attached should be carefully evaluated during the treatment planning phase. An ideally shaped ridge has a smooth, regular surface of attached mucosa. Its height and width should allow the placement of a pontic that can emerge from the ridge and mimic the appearance of neighboring teeth. However, there is a high incidence (91%) of residual ridge deformity¹ following anterior tooth loss. Alveolar ridge deformity presumably occurs due to traumatic teeth removal, severe periodontal diseases, endodontic failure, implant failure, traumatic accidents, and developmental defects.² An inadequate alveolar ridge can lead to esthetic and functional compromises, especially in the anterior maxillary region of patients with a high lip line.

Siebert classified residual ridge deformities into three categories.³ Class I is characterized by the faciolingual loss of tissue width with normal ridge height. Class II involves the loss of ridge height with normal ridge width. Class III is marked by a combination of loss in both dimensions. Class I deformities are infrequent and not esthetically challenging, and the surgical augmentation of ridge width is not common. Meanwhile, treatments of Class II and III ridge deformities present more difficulties because of the need to replace a high volume of tissue. Various grafting procedures have been developed for the reconstruction of deformed

edentulous ridges. Soft tissue autografts, such as subepithelial connective tissue grafts,⁴ onlay grafts,⁵ and hard tissue grafts (e.g., guided bone regeneration, GBR),⁶ can be used to augment residual ridges. However, few soft tissue surgical techniques may be used to increase the height of residual ridges with any predictability. Subepithelial connective tissue and onlay grafts are designed to enhance ridge height and width, making them useful for treating Class III deformities. The procedure may have to be repeated several times to reestablish a normal residual ridge because the amount of height augmentation can only be as thick as the graft.

This case report provides an approach to treating moderate apicocoronal and buccolingual ridge deformities. Two-step surgical ridge augmentation by soft tissue grafting was performed.

Case Report

A 42-year-old woman was referred to the Department of Prosthodontics, Taipei Veterans General Hospital in Taiwan with the hope of improving the esthetic appearance of her anterior maxillary fixed prosthesis. Extraoral findings revealed a convex profile with ovoid facial form. The patient had symmetric facial appearance and a gummy smile (Fig1). The dental midline was about 3.5 mm off to the right of the facial midline. Intraoral findings showed teeth loss (11, 12, 16, 17, 25, 27, 37, 46, and 47; Fig2). The six-unit fixed partial denture (FPD) between the bilateral maxillary canines with pontic space on tooth 12 was already more than ten years old. Three weeks earlier, the maxillary right central incisor was extracted due to root fracture and infection. The anterior ridge demonstrated Class III deformity with buccolingual and apicocoronal tissue loss according to Seibert's classification.³ The space between the tooth 11 pontic of the FPD and edentulous ridge was filled with com-



Fig1 Patient with a gummy smile. The dental midline is about 3.5 mm to the right of the facial midline

posite resin by the patient's last dentist. The patient exhibited a gummy smile with uneven gingival line over the teeth 13 and 23 areas. Occlusal findings demonstrated both 1 mm overbite and overjet. In addition, crossbite malocclusion of teeth 23 and 33 was noticed. Other intraoral and radiographic findings included the supra-eruption of tooth 48 with mesial tilting, continuing endodontic retreatment of 36, and dental caries on teeth 15, 21, 23, 26, 41, and 42 (Fig3).

The patient preferred to have a conventional FPD due to financial reasons and was not concerned with the crossbite malocclusion of teeth 23 and 33. Therefore, neither dental



Fig3 Panoramic radiograph before treatment



Fig2 Intraoral and extraoral findings.

- Frontal view showing Seibert Class III deformity and uneven gingival line of the maxillary canines.
- Right-side view revealing the supra-eruption of tooth 48 with mesial tilting
- Left-side view showing crossbite malocclusion of teeth 23 and 33

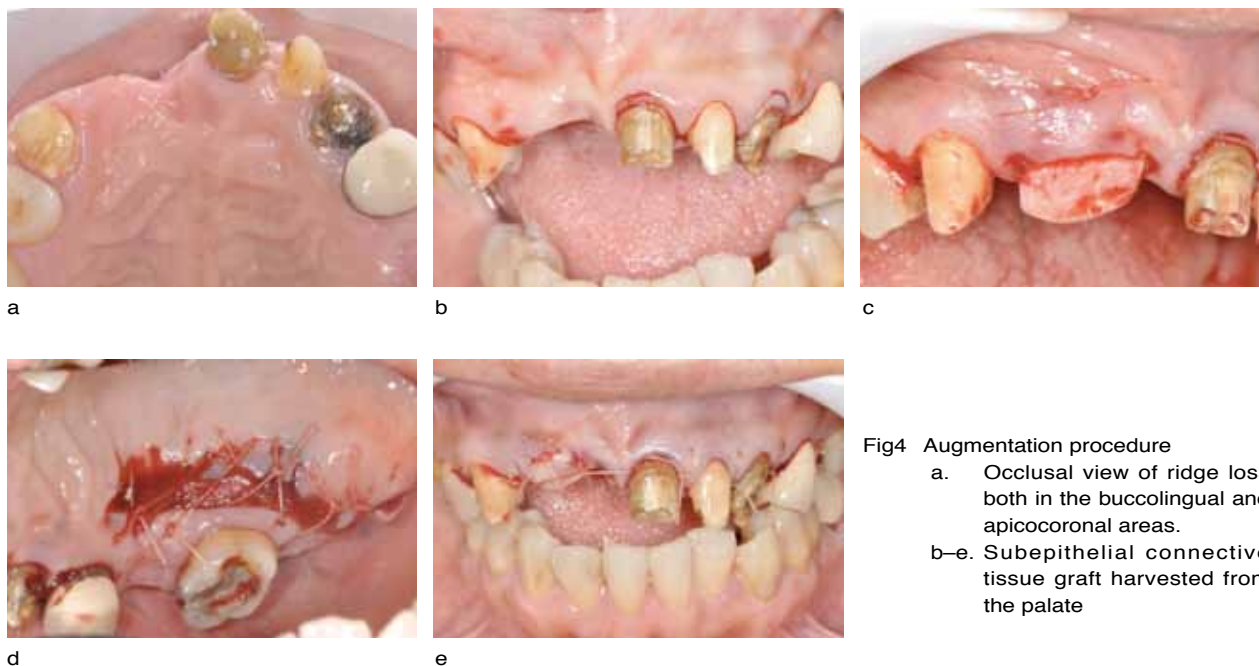


Fig4 Augmentation procedure
 a. Occlusal view of ridge loss both in the buccolingual and apicocoronal areas.
 b–e. Subepithelial connective tissue graft harvested from the palate

implant placement nor orthodontic treatment was taken into consideration. Surgical ridge augmentation was discussed with the surgeon, and decision was made to augment the ridge with a subepithelial connective tissue graft harvested from the palate. Two consecutive grafting procedures were planned because the deformity was too large. The surgical protocol was adopted from the method of Langer and Calagna who described the placement of a connective tissue graft between the facial pedicle flap and edentulous ridge.⁴ Crown lengthening was planned for tooth 23 to correct the uneven gum line.

The augmentation procedure is illustrated in Fig4. A partial-thickness pedicle facial flap was prepared on the recipient site. The subepithelial connective tissue graft was then harvested from the palate mesial to the left first premolar and extending to the distal of the first molar. Care was taken to avoid damage to the palatine artery. The soft tissue graft was positioned and light compressed to shape the edentulous ridge. The pontic of the provisional bridge was then adjusted to fit the augmented ridge with minimal pressure before suturing (Fig5). Crown lengthening for tooth 23 was performed in the same surgery. The wounds both on the donor and recipient sites were sutured using 4-0 EU-TEK (PGA) sutures (Unik Surgical Sutures Mfg. Co., Taiwan). The wound on the donor site was protected using



Fig5 Ovate pontic of the provisional bridge. It was adjusted with minimal pressure to fit the augmented ridge

a non-eugenol-based dressing (Coe-Pak, GC America). The sutures were removed after 14 days of wound healing.

Post-operative instructions included daily chlorhexidine mouth rinsing and the use of prescribed analgesics. The sutures were removed ten days after surgery, and good soft tissue healing was observed. The ovate pontics were adjusted at regular post-surgery follow-up appointments to achieve optimal cervical contour. Significant ridge improvement was realized, but minor ridge deformity still existed. An identical procedure of soft tissue grafting was performed six months later. Six months



Fig6 Six months after the second surgical ridge augmentation, the edentulous ridge healed with adequate (a) buccolingual and (b) apicocoronal contours



Fig7 Provisional fixed partial dentures with improvement in both functional and esthetic outcomes six months after the second surgery

after the second surgery, the edentulous ridge healed with adequate buccolingual and apicocoronal contours (Fig6). No visible change was observed in the shape of the soft tissue, and the patient was satisfied with the appearance of her provisional FPD (Fig7). Thus, the final impression was taken, and the final fixed prosthesis was fabricated (Fig8)

and cemented (Fig9 and 10). The final fixed prosthesis design included a four-unit porcelain-fused-to metal (PFM) FPD (teeth 13 to 21), three-unit PFM FPD (teeth 24 to 26), and three single PFM FPDs (teeth 22, 23, and 36). Follow-up examinations for ten months confirmed a stable outcome (Fig11).



a



b



c



d

Fig8

- a, b Final impression with condensation-type silicone.
- c, d Upper and lower master casts.
- e, f Metal framework try-in of the fixed partial dentures



e



f



a



b



c



d

Fig9 a-d Satisfactory final restoration



Fig10 Panoramic radiograph of the final prosthesis



Fig11 Prosthesis after ten months of follow-up

Discussion

Various augmentation procedures are available for the improvement of alveolar ridge deformities. Seibert described the use of a thick free gingival onlay graft to enhance ridge height and replace disfigured or traumatized tissue.⁷ However, the use of onlay grafts has some disadvantages, including post-operative necrosis in case of inadequate blood supply,⁸ unpredictable shrinkage of grafts,^{9,10} and the generally pale tissue color resulting in unaesthetic appearance.³ The subepithelial connective tissue graft described by Langer and Calagna⁴ was used in this case to preserve tissue color and the texture of the underlying mucosa, resulting in better esthetics. A review

by Thoma illustrated that subepithelial connective tissue grafts provide greater soft tissue volume than free gingival grafts,¹¹ although further research is needed. Moreover, subepithelial connective tissue grafts receive more vascular nourishment, thus decreasing the possibility of post-surgery necrosis.

The major disadvantage of using connective tissue grafts is the need for a second surgical site. However, grafting does not appear to be technique sensitive compared with augmentation, which uses bone-substitute materials or GBR. Ridges augmented with connective tissue grafts have demonstrated stability for 7 to 12 years.^{9,12} Nevertheless, patients must be informed that because

wound healing is a long-term process,¹³ the shrinkage of augmented soft tissues is in part unpredictable.

FPD pontics have to fulfill esthetic, functional, and hygienic requirements. The ovate pontic design used in this case was intended for the fabrication of a concave soft tissue outline in the edentulous ridge to mimic the natural emergency profile.¹⁴ The major advantage of the ovate pontic is its ability to achieve maximum esthetics. However, sufficient faciolingual width and apicocoronal thickness are required for housing the ovate pontic. Hence, additional surgical procedures are frequently required to augment the edentulous ridge. The ovate pontic of the provisional FPD should be adjusted in light contact with underlying soft tissue following surgical augmentation.^{15,16} Regular follow-up appointments must be scheduled to adjust the interim FPD and guide the soft tissue to an ideal contour. Furthermore, plaque control by patients eliminates periodontal inflammation and plays a major role in the stability of plastic surgery.

Conclusion

This case report illustrates the esthetic reconstruction of a Siebert Class III ridge deformity. A two-step approach using subepithelial connective tissue grafts can be employed to achieve an ideal gingival contour and is helpful in treating patients like the one in this case. The apicocoronal and buccolingual augmentation of the edentulous ridge improves both functional and esthetic outcomes. Long-term processes for augmented soft tissue remodeling are required. About six months is needed before the final prosthesis can be constructed.

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