

CASE REPORT

Window Approach for Simultaneous Root Fragment Removal and Implant Placement: Two Case Reports

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Introduction: Root fracture during extraction is not uncommon due to the presence of multiple and thin roots, which are often divergent and curved. The retained root fragments (RF) are usually radiographic incidental findings and often asymptomatic without associated pathology. However, careful and conservative surgical strategies for the removal of RF must be incorporated to allow for simultaneous implant placement and to avoid potential complications such as compromised osseointegration or retrograde peri-implantitis. Conventional RF removal techniques may lead to a significant amount of bone removal, involving more trauma and a prolonged healing period.

Case Presentation: In these two case reports, the Window Approach for Simultaneous Root Fragment Removal and Implant Placement (WAS RIP) technique was used to extract RF in a minimally invasive fashion to preserve both the coronal and apical bone, which are critical components in providing mechanical stability for simultaneously placed implants. All implants presented in both cases showed adequate primary stability and successfully achieved osseointegration at a 3-month follow-up period.

Conclusion: Through the buccal window, sufficient access was provided to remove RF atraumatically with maximal retention of surrounding bone that led to predictable implant placement. *Clin Adv Periodontics* 2022;12:204–209.

Key Words: dental implant therapy; peri-implantitis; alveolar ridge; alveolar ridge augmentation; bone regeneration.

Background

Root fracture during extraction is a common intraoperative complication due to the presence of multiple roots, thin and brittle roots, divergent or dilacerated root shapes, and iatrogenic trauma.¹ Maxillary premolars are found to be the most frequently fractured teeth with retained root fragments (RF).² The presence of a retained RF undetected during implant placement has been reported as a potential source of pathogens in the etiology of peri-implantitis and retrograde peri-implantitis.^{1,3,4} Prophylactic extraction of RF either before or during implant placement is highly recommended.^{3,4} However, surgical access to RF often necessitates varying degrees of bone reduction around the osteotomy, and subsequently, the mechanical stability of implants may be compromised and patients may experience increased postoperative morbidity and prolonged wound healing. Here, we introduce a novel minimally invasive technique of removing a retained RF and predictable simultaneous implant placement:

Window Approach for Simultaneous Root Fragment Removal and Implant Placement (WAS RIP) (Figure 1).

Case 1

Clinical Presentation

A 35-year-old female patient presented to Columbia University College of Dental Medicine (CUCDM) Postgraduate Periodontics Clinic on June 2, 2021 with a missing tooth #5. The tooth was extracted 1.5 years prior to the initial visit and a concomitant ridge preservation procedure had been performed. Upon radiographic examination, a radiopacity of 8×3 mm at the edentulous ridge was noticed and the lesion was suspected to be a residual RF (Figure 2A–D).

Case Management

Oral consent was obtained prior to the surgery. A paracrestal incision was made on the edentulous site and intra-sulcular incisions combined with two vertical releasing incisions at the mesial line angle at tooth #6 and distal line angle at tooth #3 were made. Full-thickness flaps were reflected and a “buccal window” was carefully created at the estimated site using a round #4 diamond bur to access the RF (Figure 2E). The RF was identified and removed with elevators and root tip forceps. The design of the buccal bony window allowed the preservation of both the crestal and apical alveolar bone at the edentulous site as they were both critical for achieving implant primary stability (PS) (Figure 2F). A 4.1×12 mm implant

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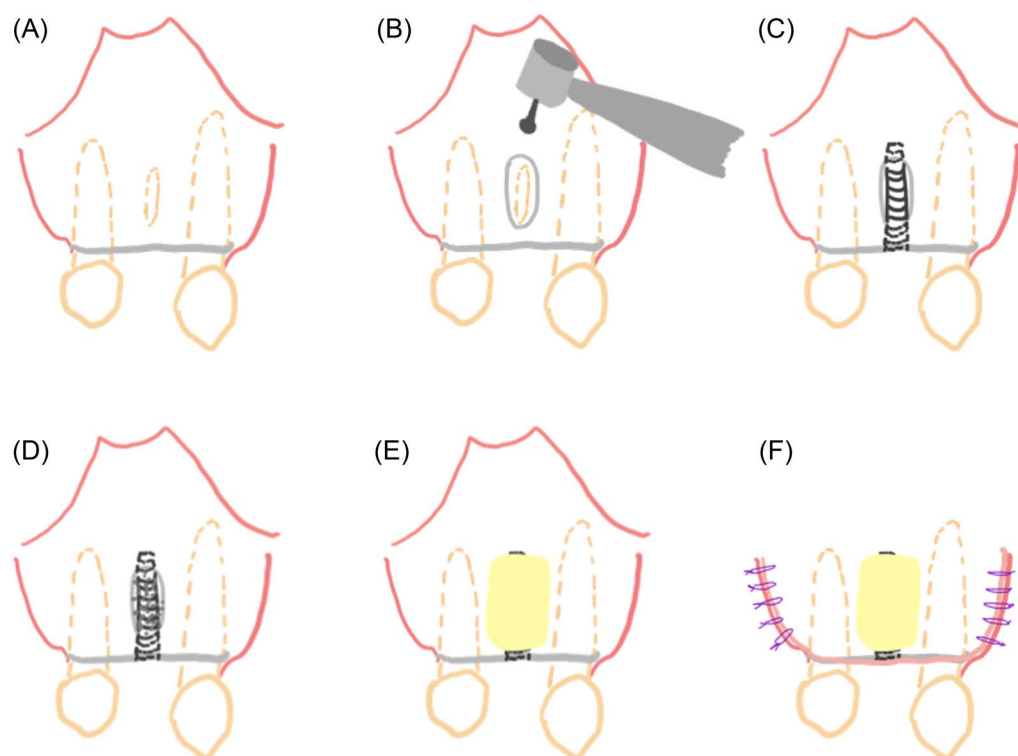


FIGURE 1 Window Approach for Simultaneous Root Fragment Removal and Implant Placement (WASRIIP) protocol. (1a) Full-thickness flap reflection and root fragment (RF) identification. (1b) Preparation of window by diamond round bur. (1c) Implant osteotomy preparation and implant placement upon RF removal and defect degranulation. (1d) Guided bone regeneration around the defect and implant with particulate graft. (1e) Resorbable membrane covering the defect and graft. (1f) Flap closure with simple interrupted configuration.

fixture[‡] was placed following the osteotomy preparation. Concurrently, guided bone regeneration (GBR) around the space between the bony housing and the implant was performed with cortico-cancellous allograft[#] and a resorbable collagen membrane[§]. Flaps were closed and healed uneventfully (Figure 2H–M).

Clinical Outcomes

At a 3-month follow-up, periapical radiographs were taken and a stable crestal bone at the implant fixture platform was observed. The implant successfully achieved osseointegration and second stage surgery was performed at the same visit (Figure 2N–O).

Case 2

Clinical Presentation

A 32-year-old female presented to CUCDM Postgraduate Periodontics Clinic on June 16, 2021 for replacing a missing tooth #13 with a dental implant (Figure 3A,B). Periapical and panoramic radiographs showed that RF

located approximately at the center of the ridge between the sinus floor and alveolar crest (Figure 3C,D).

Case Management

Oral consent was obtained prior to the surgery. A full-thickness flap was raised after making a vertical releasing incision at tooth #11, intrasulcular incisions around tooth #12 and 14, and a midcrestal incision in the edentulous ridge. A buccal window was created with a #4 diamond round bur. The RF was visualized and extracted with an elevator (Fig. 3E–G). An osteotomy of was prepared using the manufacturer's protocol followed by a 4.1 × 12 mm fixture* placement. With PS of 20 Ncm, a cover screw was inserted. The space between the fixture and surrounding bone was grafted with cortico-cancellous particulate allograft^{||} and covered with resorbable collagen membrane[¶]. Flaps were closed using simple interrupted sutures (Figure 3H–M).

Clinical Outcomes

At a 3-month follow-up, a periapical radiograph showed increased mineralization of the grafted particles. With

[‡]Roxolid Bone Level Tapered, Straumann Holding AG, Basel, Switzerland.

[§]Geistlich Bio-Gide, Geistlich Pharma North America Inc., Princeton, NJ, USA.

^{||}Puros Cortico-Cancellous Particulate Allograft 250-1,000 μ m, Zimmer Biomet, Warsaw, IN, USA.

[¶]Genoss Collagen Membrane, Genoss Co. Ltd., Seoul, Republic of Korea.

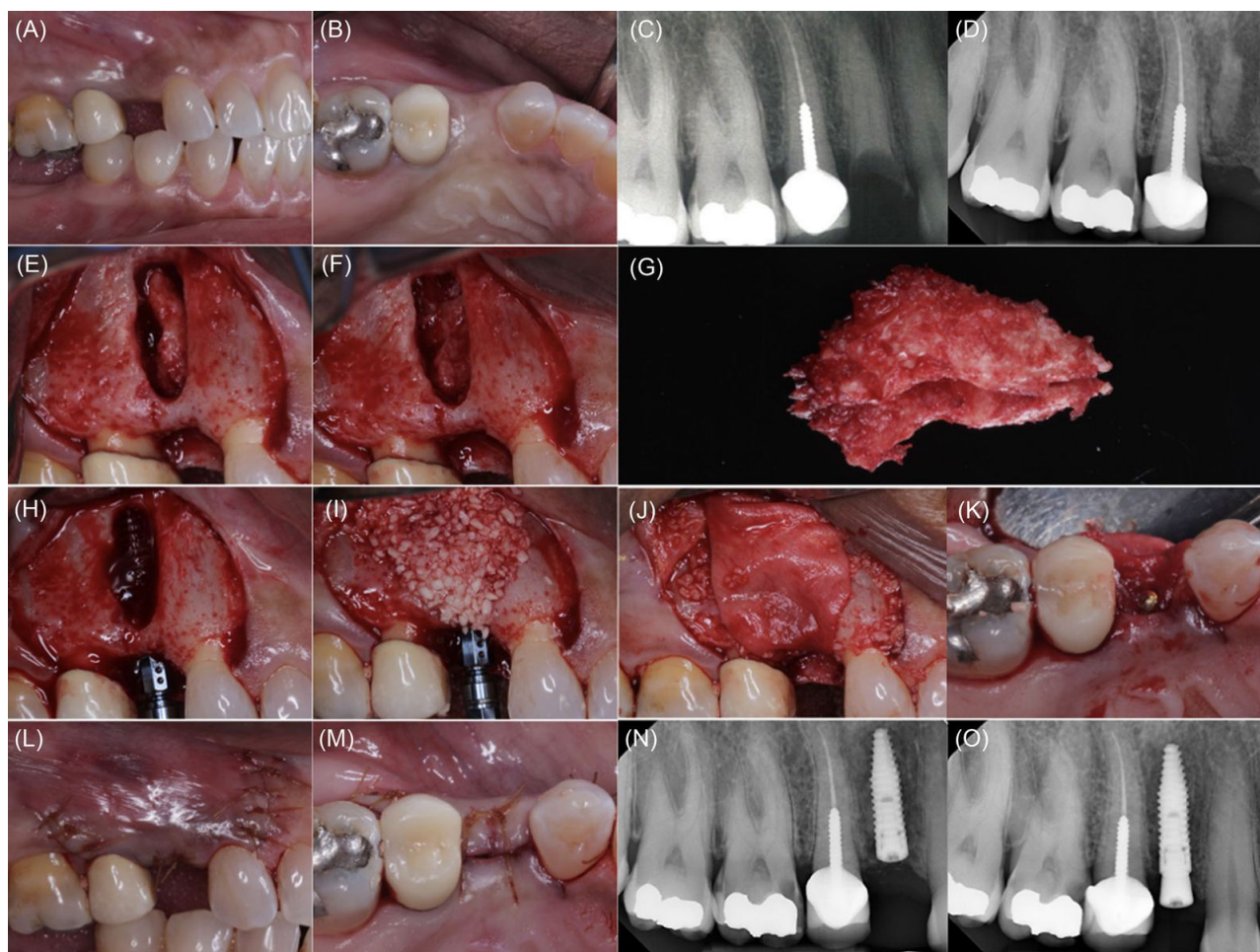


FIGURE 2 Case 1 with WASRIP. (2a, 2b) Buccal and occlusal view of initial presentation. (2c) Periapical film from general dentist prior to #13 extraction. (2d) Periapical film at initial presentation. (2e) Window preparation and root fragment (RF) identification. (2f) RF removal and degranulation. (2g) RF removed showing fibrous tissue and remnant of particulates from previous procedure. (2h) Osteotomy preparation and implant placement. (2i, 2j) Guided bone regeneration with particulate particles and resorbable membrane. (2k) Resorbable membrane secured with cover screw. (2l, 2m) Flap closure with simple interrupted configuration. (2n) Periapical film immediately after implant placement. (2o) Three-month follow-up and stage 2 surgery.

clinical verification of successful osseointegration, second stage surgery was performed at the same visit (Figure 3N–O).

Discussion

In these case reports, the WASRIP technique was used to remove RF while allowing the preservation of the alveolar bone crest, coronal and apical bone, in particular, for predictable simultaneous implant placement. Spyropoulos et al. reported the prevalence of residual RF on panoramic radiographs in 368 patients. The authors observed that 30% of them presented RF and the posterior maxilla was the area with the highest prevalence⁵ (Figure 4).

In both cases, RF was radiographic finding and had no associated pathology. The key question would be “Is it necessary to remove retained RF?”. Techniques such as partial extraction technique,⁶ socket shield technique,⁷ and root membrane technique⁸ have been introduced yet with scarce evidence of long-term survival and success

results. Nevins et al.³ and Langer et al.⁴ have shown that the presence of an undetected RF during implant placement is a potential source of pathogens for peri-implantitis and retrograde peri-implantitis. The highest incidence of retrograde peri-implantitis is in the maxillary premolar and molar areas, which have been shown to have more RF^{1,5} (Figure 5). Given the unpredictability of a retained RF in contact or in close proximity of the implant, the removal of RF is highly advised.

Conventional methods of removing RF oftentimes require a varying degree of bone removal, especially the buccal and coronal alveolar bone, to allow sufficient access. Such sacrificial reduction of the surrounding bone may create osteotomies that are not amenable to simultaneous implant placement and may require additional GBR prior to implant placement.¹ In the WASRIP technique, the bony window on the buccal bone can be prepared by using multiple instruments such as diamond burs, as shown in the presented cases, or piezoelectric tips. The accessibility to the RF is significantly improved while enabling the preservation of neighboring bony

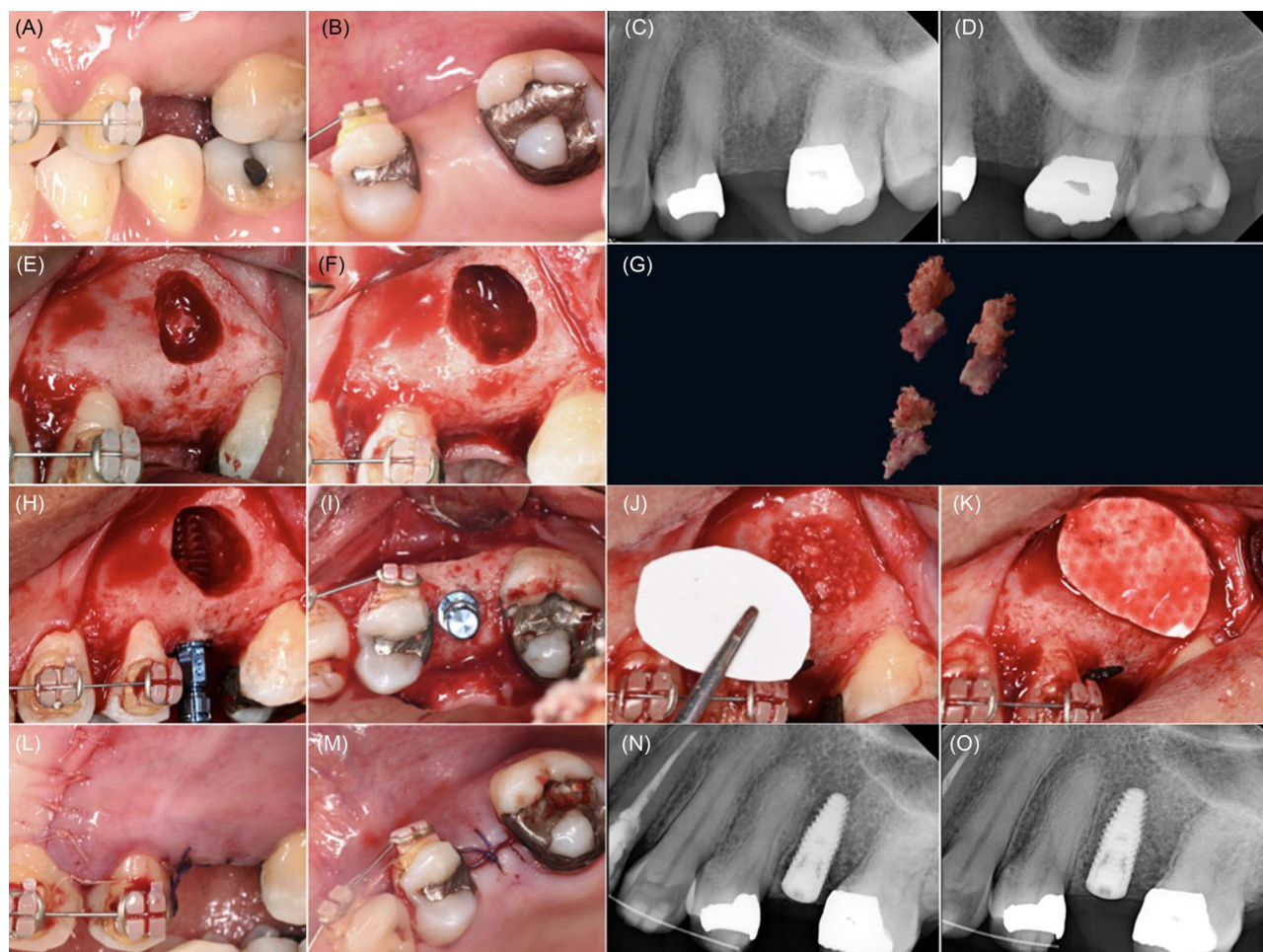


FIGURE 3 Case 2 with WASRIP. (3a, 3b) Buccal and occlusal view of initial presentation. (3c, 3d) Periapical radiographs using Same Lingual Opposite Buccal (SLOB) rule to identify the buccopalatal location of the root fragment (RF) in the alveolar ridge. (3e) Window preparation and RF identification. (3f) RF removal and degranulation. (3g) RF removed showing fibrous tissue and remnant of particulates from previous procedure. (3h, 3i) Osteotomy preparation and implant placement with preservation of coronal crestal bone from buccal and occlusal view. (3j, 3k) Guided bone regeneration with particulate particles and resorbable membrane. (3l, 3m) Flap closure with simple interrupted configuration. (3n) Periapical film immediately after implant placement. (3o) Four-month follow-up.

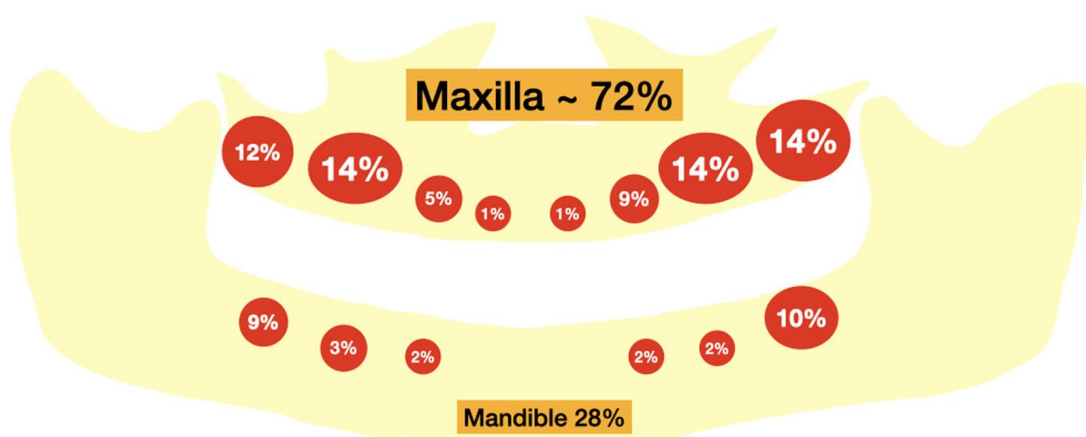


FIGURE 4 Residual root fragment (RF) prevalence according to Spyropoulos et al.⁵

architecture. Similarly to what has been shown for the lateral sinus augmentation with simultaneous implant placement technique, WASRIP allows the preservation of the alveolar bone crest even in extreme atrophic ridges with residual bone height as small as 1–3 mm, enhancing

the PS and overall success and survival of the implant.^{9–11} Subsequent to implant placement, the empty space between the fixture and surrounding bone can be grafted with various bone substitutes and membranes of choice, similar to lateral wall sinus augmentation procedures.⁹

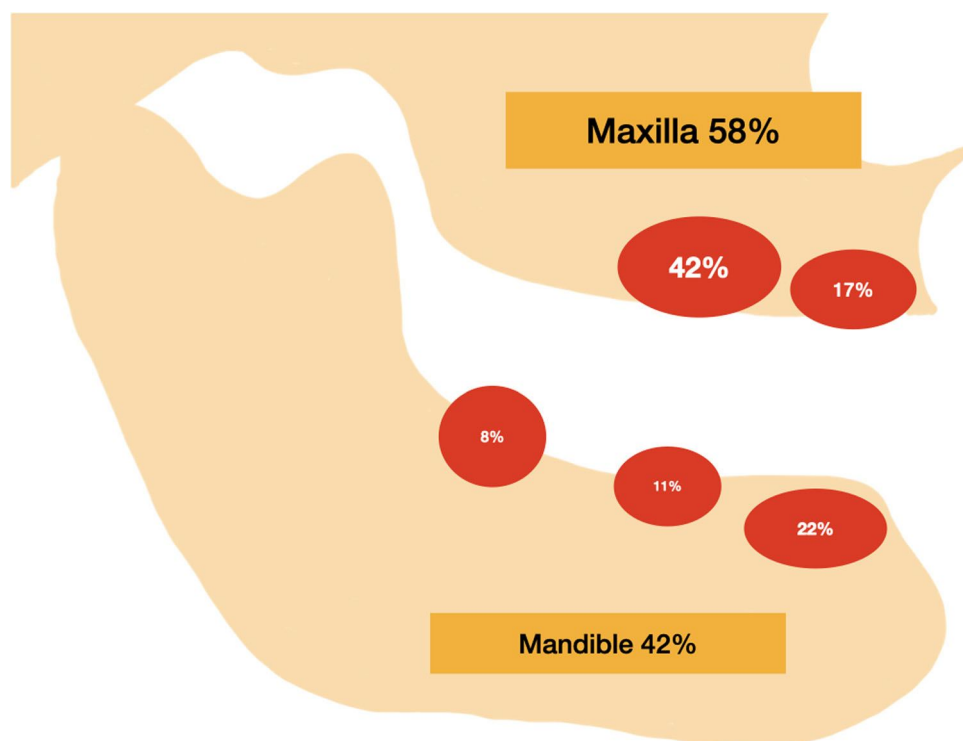


FIGURE 5 Retrograde peri-implantitis incidence according to Park et al.¹

Furthermore, the coronal strip of the buccal plate serves as a well-confined boundary for GBR, which contains the graft particles within natural bony housing with sufficient vascular supply from all directions, resulting in a more predictable GBR.¹²

Possible risks and complications of WASRIP could be related to the invasion of neighboring anatomical structures such as the roots of adjacent teeth, the maxillary sinus, and the inferior alveolar nerve. In this regard, cone beam computer tomography would aid in the pre-

cise location of the RF in the alveolar bone, especially in the bucco-lingual dimension, to avoid damaging to anatomical structures.

Conclusion

We propose the WASRIP technique to retrieve RF by creating a buccal bony window that allows access to the RF, preservation of the alveolar bone crest and predictable simultaneous implant placement. ■

Summary

Why are these cases new information?	■ Introducing a predictable and minimally invasive approach to access root fragments and simultaneous implant placement.
What are the keys to successful management of these cases?	■ Minimally invasive access to root fragments through a buccal bony window. ■ Preservation of the alveolar bone crest and the apical bone for simultaneous implant placement with ideal primary stability. ■ Preservation of the coronal part of the alveolar crest to serve as a defined margin for guided bone regeneration.
What are the primary limitations to success in these cases?	■ Width of band of preserved buccal coronal alveolar plate.

Conflict of Interest

The authors declare no conflicts of interest.

Author Contributions

Yi-Chu Wu and Gretel Pellegrini contributed to conception, design, surgical treatment, and graphic design, and drafted and critically revised the manuscript. Leonard Garfinkel contributed to conception, design, and surgical supervision, and critically revised the manuscript. Philip Kang critically revised the manuscript. All authors gave final approval and agreed to be accountable for all aspects of the work.

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