

Amnion-Chorion Membrane in Open-Wound Approach for Localized Horizontal Ridge Augmentation: A Case Series Report

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Disclaimer:

Dr. Chan is a consultant of the Snoasis Medical, Denver, Colorado, USA. The other authors do not have any conflict of interest related to this project.

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1902/cap.10144](https://doi.org/10.1902/cap.10144).

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Word count: 996

Number of figures: 15

Number of references: 10

Running title: Open-Wound GBR

One-sentence summary: Three cases were described in which amnion-chorion membranes were employed to enable a promising open-wound approach for contained, and localized horizontal ridge augmentation that avoided the need for invasive surgical flaps.

Author contribution statement

Dr. Shan-Huey Yu contributed to data analysis, data interpretation, manuscript preparation, and final approval of the manuscript.

Dr. Tae-Ju Oh contributed to data interpretation, manuscript preparation, and final approval of the manuscript.

Dr. Hom-Lay Wang contributed to conception of the work, manuscript preparation, and final approval of the manuscript.

Dr. Hsun-Liang Chan contributed to data collection, analysis, interpretation, manuscript preparation, and final approval of the manuscript.

Abstract

Introduction

Guided bone augmentation often requires extensive releasing of the mucoperiosteal flap to achieve primary wound closure, an invasive procedure that can compromise the keratinized tissue volume and increase patient morbidity. Amnion-chorion membranes have been used to actively promote healing in chronic open-wound situations in the medical field, suggesting that they could be used in a similar manner in the oral cavity. The ability to use open-wound healing techniques for guided bone regeneration would allow clinicians to avoid invasive procedures that cause additional tissue trauma at the surgical site.

Case Series

Amnion-chorion membranes were applied over the bone grafting material augmenting localized horizontal ridge defects, and a gap between the flaps was left intentionally during healing. No flap releasing procedures were performed in these cases, which demonstrated uneventful soft tissue healing, good volume of bone regeneration and preserved keratinized tissue.

Conclusions

Preliminary clinical outcomes suggested contained minor horizontal ridge defects may be treated satisfactorily in a controlled, open-wound healing manner that reduces surgical trauma, chair time, and patient morbidity.

Key words: Amnion, Chorion, Microsurgery, Wound healing, Alveolar ridge augmentation, Dental implants, Surgical flaps

Background

Guided bone regeneration (GBR) is an established and predictable method to augment deficient ridges.¹ Currently, primary wound closure is considered a prerequisite for a predictable outcome in GBR cases because it is the safest way to ensure that the augmentation site is not compromised following the placement of graft materials.² Because graft materials add volume to the ridge, soft tissue releasing techniques have been developed to mobilize flaps that can be stretched over the site to achieve primary wound closure.³ Flap releasing procedures are technically challenging, especially in cases with shallow vestibule and low elasticity (scar) tissues, according to clinical experiences, and the additional internal cuts or vertical releasing incisions used to mobile the flaps increases tissue trauma, surgical time, and post-surgical morbidity.³

Even with deliberate soft tissue management, wound exposure is estimated to occur in approximately 20% of the cases, indicating that primary closure, alone, is susceptible to failure.⁴ A systematic review showed that when either passive absorbable or non-resorbable membranes were used, some bone formation was observed even when wound exposure occurred.⁵ In socket augmentation procedures, it has become a routine that primary closure is not required, and an additional benefit is the maintenance/increase in keratinized tissue width.⁶ Arguably to say the extraction socket has a high healing potential; nevertheless, certain less-challenging ridge defects could render open-wound healing to mitigate the adverse outcomes of flap releasing. It is especially beneficial if a material can actively promote healing in open-wound environment. Such an example is the amnion-chorion membrane*, which has been widely used for accelerating healing of chronic

open wounds in the extremities⁷, corneas⁸, and oral mucosa.⁹ In contrast to commonly used passive membranes, this membrane[†] contains active growth factors, cytokines, extracellular matrix components and antibacterial properties that allow for rapid revascularization, re-epithelialization and bacterial inhibition.^{10, 11} Satisfactory open-wound healing of intact extraction sockets with this membrane has also been demonstrated.¹² Therefore, the goal of the following cases was to evaluate the use of amnion-chorion membranes in the open-wound approach for treating localized small (2-3mm) horizontal ridge defects.¹

A written consent for treatment was received for the 3 cases described below.

Case 1

Clinical Presentation/Management and Clinical Outcomes

The patient was a 48-year-old female patient without significant medical history, presenting on 5/24/2019 with a horizontally deficient edentulous ridge at #3 and #4 sites (Figure 1a). While performing lateral window sinus lift, the buccal concavity was confirmed (~3 mm defect) upon full thickness flap reflection (Figure 1b). Allograft cortical bone particulates[‡] was placed and covered with the amnion-chorion membrane. The buccal and lingual flap was sutured with a ~2mm gap (Figure 1c). Post-operative medications included Amoxicillin 500 mg TID for 7 days, Ibuprofen 600 mg Q4-6h, and Dexamethasone 2 mg with a total of 9 tablets in tapering schedule of 4 days. The patient returned for 1-week check and the membrane could still be seen in situ with uneventful healing (Figure 1d). An implant surgery was performed four months later; the increased bone volume was adequate

for standard-sized implant placement (Figure 1e). After three months, the two integrated implants were uncovered with sufficient facial bone thickness (Figure 1f).

Case 2

Clinical Presentation/Management and Clinical Outcomes

This patient was a 45-year-old female presented on 1/9/2014 for implant therapy at the mandibular right posterior edentulous ridge with thin alveolar ridge crest (Figure 2a). Staged GBR was performed on the buccal concavity with intra-marrow penetration, followed by placement approximately 5 mm in width of the particulate bone allograft[†] covered with two layers of membrane: collagen membrane[§] at the inner surface and amnion-chorion membrane at the outer layer (Figure 2b). Whether this double layer approach is required or a single layer of either a passive collagen membrane or an amnion-chorion membrane is sufficient deserves further evaluation. Nevertheless, the wound was intentionally left exposed with ~3 mm gap (Figure 2c). The same postoperative regimen as case 1 was provided. After four months, there was approximately 3 mm horizontal bone regeneration (Figure 2d).

Case 3

Clinical Presentation/Management and Clinical Outcomes

This patient presented on 3/7/2019 for implant therapy to replace missing #30. The occlusal view demonstrated a buccal concavity as well as limited keratinized tissue (Figure 3a). A buccal bony defect was confirmed (Figure 3b), which was subsequently augmented with the same bone allograft and membrane without

complete flap approximation. At 1-week, the membrane could be seen between the flaps (Figure 3c). Four months after, there was improved buccal ridge contour as well as gain of keratinized tissue (Figure 3d). There was approximately 1 mm facial bone at the osteotomy site (Figure 3e).

Discussion

Currently, a paradigm shift in regenerative periodontics is occurring in which microsurgical approaches that minimize soft tissue damage are being favored over macrosurgical approaches that aim for access.¹³ Given the complex wound healing environments that are common to regenerative surgeries, limiting unnecessary tissue trauma is becoming an important goal in surgical designing.¹⁴ By minimizing the extent of soft tissue damage from flap scoring, regenerative procedures that take conservative, microsurgical approaches to reduce the extent of surgical incision and flap releasing ultimately preserve native tissues that provide critical structural support around the wound site, including intact tissue layers and vasculature.¹⁴ The conservative flap manipulation, reflection, and mobilization techniques employed in this case series preserve vasculature, decrease soft tissue trauma, and facilitate grafting material stabilization, leading to satisfactory healing at the open-wounded site.

Another periodontal innovation is the use of biologics to boost the initial healing cascade events.¹³ Amnion-chorion membranes may encourage flap edge approximation by providing extracellular matrix scaffolds containing growth factors, cytokines and matrix proteins.^{7,8} They may act as a jump start to effectively promote rapid epithelialization and granulation tissue formation that can seal the wound gap

in a timely manner.^{7,8} The antimicrobial elements within the membrane are likely to inhibit bacterial growth.¹⁵ This combined surgical technique modification and the particular material selection could well result in favoring the progenitor cells to overcome the challenges arising from an opened wound. Needless to say, this case series is by no means to confront the central dogma of regenerative medicine, that is attempting primary wound closure for achieving optimal clinical outcomes. However, this pilot study with limited sample size, with only uncalibrated clinical photos for demonstration, and without a control aimed to provide preliminary data that contained small (2-3mm) horizontal ridge defects may be treated uneventfully in a controlled open wound healing manner that may allow for reduced surgical trauma, time and morbidity.

Conclusion

Open wound healing for guided bone regeneration with amnion-chorion membranes may achieve an acceptable outcome in selective cases. Comparative studies with a control group and sufficient samples are required to confirm these preliminary findings.

Summary

<ul style="list-style-type: none"> • Why is this case new information? 	<p>Contradict to current closed wound approach, in certain non-challenging localized and contained horizontal ridge defects, the controlled open wound approach may be applied to reduce the trauma, time and morbidity.</p>
<ul style="list-style-type: none"> • What are the keys to successful management of this case? 	<ul style="list-style-type: none"> • Case criteria: Contained localized (2-3mm) horizontal ridge defects could be more predictable • Surgical approach: Minimally invasive approach with controlled small open wound

	<ul style="list-style-type: none"> • Material selection: Bioactive membrane that provides wound scaffold and promotes healing
<ul style="list-style-type: none"> • What are the primary limitations to success in this case? 	<ul style="list-style-type: none"> • Unpredictable host healing potential • Size and type of the ridge defect • Large wound opening • Early membrane resorption

†BioXclude, Snoasis Medical Inc, Denver, CO, USA

‡ Cortical allograft bone particulates, Maxxeus Dental, Dayton, OH, USA

§ Biomend Membrane, Zimmer Biomet, Warsaw, IN, USA

Acknowledgment

The authors would like to thank Drs. Frank Z Sun, DDS and Grace Wu, DDS, private practitioners, Novi, Michigan, USA for providing resources for performing these procedures, Dr. Pete Mariner, PhD. Chief Scientific Officer. Snoasis Medical, LLC for assisting in preparation of this manuscript, and Snoasis Medical, LLC for providing the membranes at no cost. Although Snoasis provided materials for this

case series, it did not act to influence the results of these cases or the descriptions thereof.

Conflicts of Interest

Dr. Chan is a consultant of the Snoasis Medical, Denver, Colorado, USA. The other authors do not have any conflict of interest related to this project.

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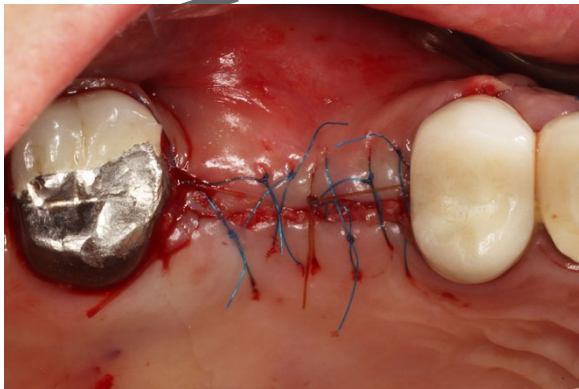
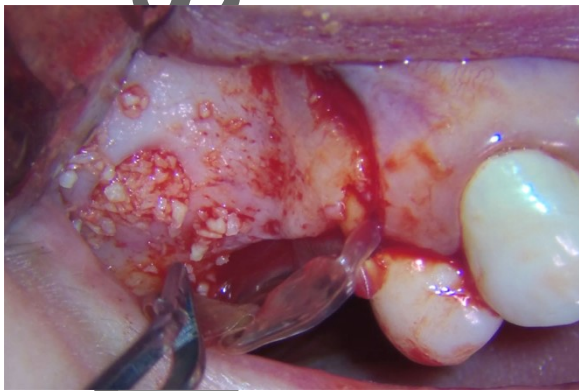
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Figure Legends

Figure 1a. Pre-treatment occlusal view of edentulous #3 & 4 site with buccal concavity. 1b. Lateral window sinus elevation was performed, and upon full thickness flap elevation, a defect approximately 3mm horizontal deficiency on the buccal is noted (**BEFORE IMAGE**). 1c. The buccal and lingual flap was sutured with a ~2mm gap left following the open-wound healing concept. 1d. At 1-week post-operative follow up, the membrane could still be seen in situ with uneventful healing. 1e. After 4 months of healing, upon flap reflection, the increased bone volume was adequate for placement of standard-sized implants (**AFTER IMAGE**). 1f. Three months after implant placement, the 2 integrated implants were surrounded by sufficient bone and were ready for prosthesis restoration.



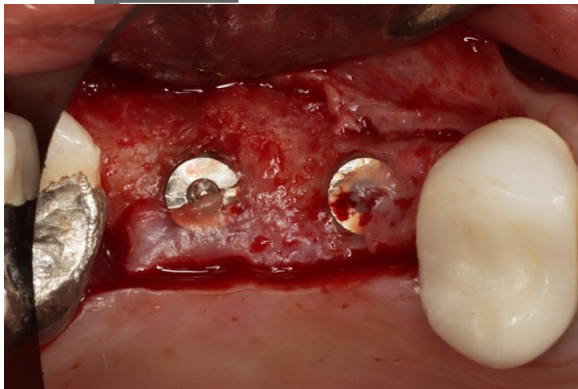
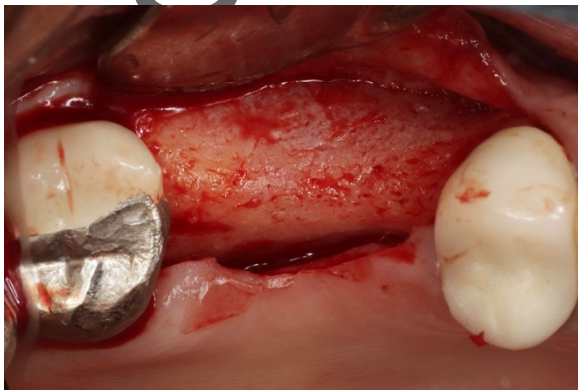
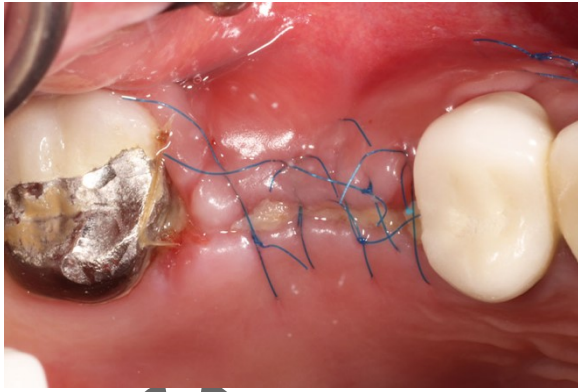
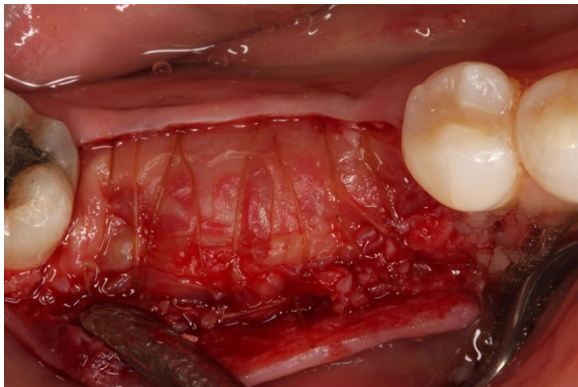
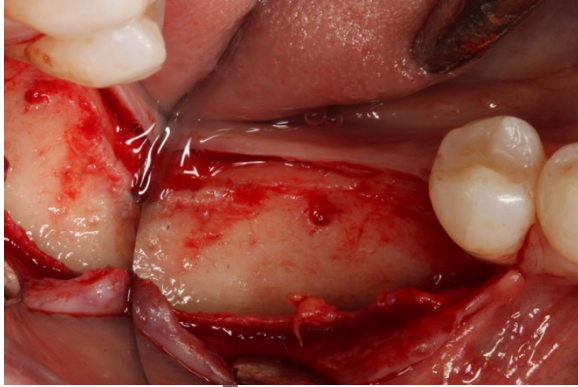


Figure 2a. Upon flap reflection, thin alveolar ridge crest and buccal concavity can be noted at the mandibular right posterior edentulous ridge. 2b. GBR was performed with placement of particulate bone allograft covered with two layers of membrane collagen membrane at the inner surface and amnion-chorion membrane at the outer layer. 2c. A 3mm gap between the buccal and lingual flap was left intentionally

following the open-wound healing concept. 2d. Following 4 months of healing, upon flap reflection for implant placement, there was approximately 3 mm horizontal bone gain.



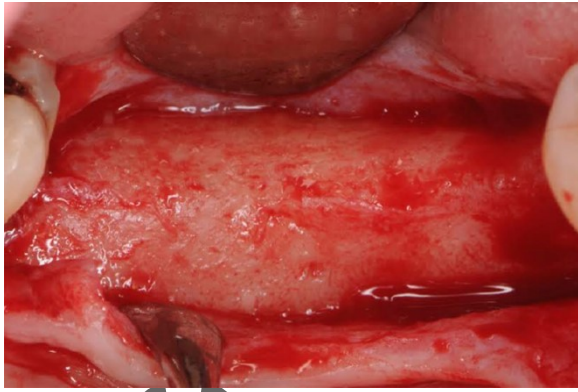
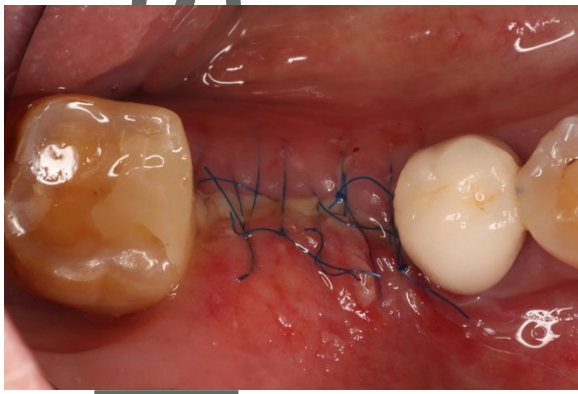
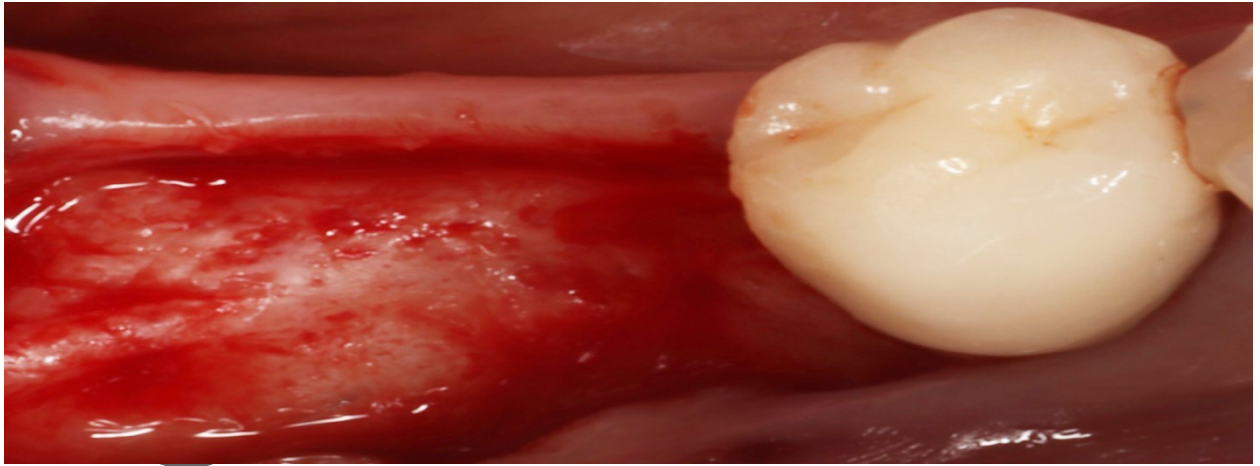
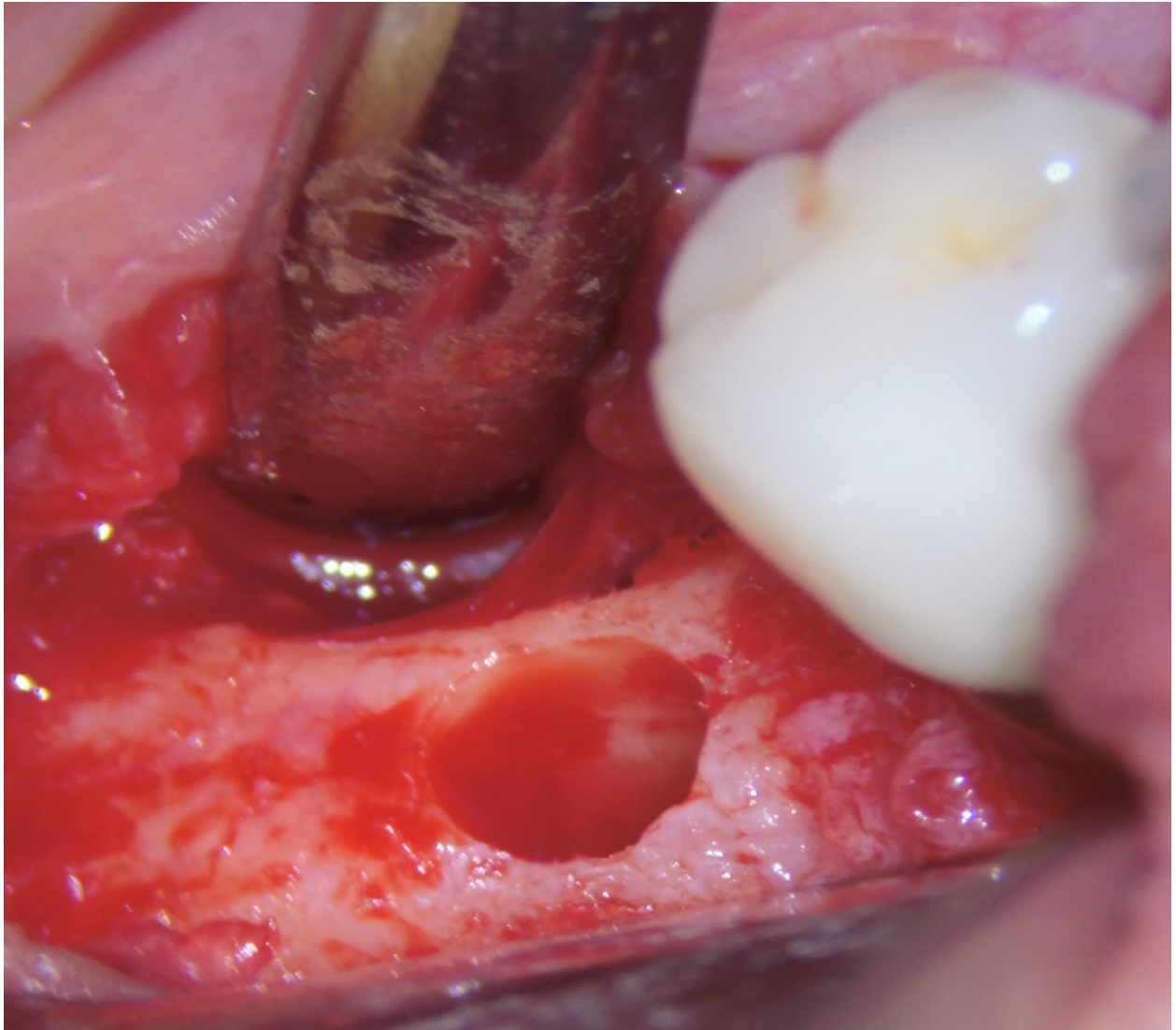


Figure 3a. The occlusal view before flap reflection at #30 edentulous site demonstrated a buccal concavity as well as limited keratinized tissue. 3b. Full thickness flaps were elevated, and a buccal bony defect was confirmed. GBR was performed with bone allograft and amnion-chorion membrane without complete flap approximation. 3c. One week after the surgery, the membrane can be seen covering the gap between the flaps. 3d. Four months after the GBR, the occlusal view demonstrated improved buccal ridge contour as well as gain of keratinized tissue. 3e. At the re-entry appointment for the implant placement, there was sufficient facial bone at the osteotomy site.





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Video Links

1. Placement of the bone allograft and amnion-chorion membrane in open-wound GBR of Case 1:

<https://drive.google.com/file/d/1kta5zUtUuLLUSr7qZnRUMj-ljnpUleOP/view?usp=sharing>

2. The osteotomy procedure in Case 3:

<https://drive.google.com/file/d/1QExmr3G4HG4uiLEW-wOPTkofZrQjIZG7/view?usp=sharing>

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