

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

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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. Minor 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. *Clin Adv Periodontics* 2022;12:101–105.

Key Words: Alveolar ridge augmentation; amnion; chorion; dental implants; microsurgery; surgical flaps; wound healing.

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 mobilize 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 ≈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 extremities,⁷ corneas,⁸ 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 to 3 mm) horizontal ridge defects.¹

A written consent for treatment was received for the three 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 May 24, 2019 with a horizontally deficient edentulous ridge at #3 and #4 sites (Fig. 1a). While performing lateral window sinus lift, the buccal concavity was confirmed (≈3-mm defect) upon full thickness flap reflection (Fig. 1b). Allograft cortical bone particulates[‡] were placed and covered

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†BioXclude, Snoasis Medical, Denver, CO.

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

§Biomend Membrane, Zimmer Biomet, Warsaw, IN.

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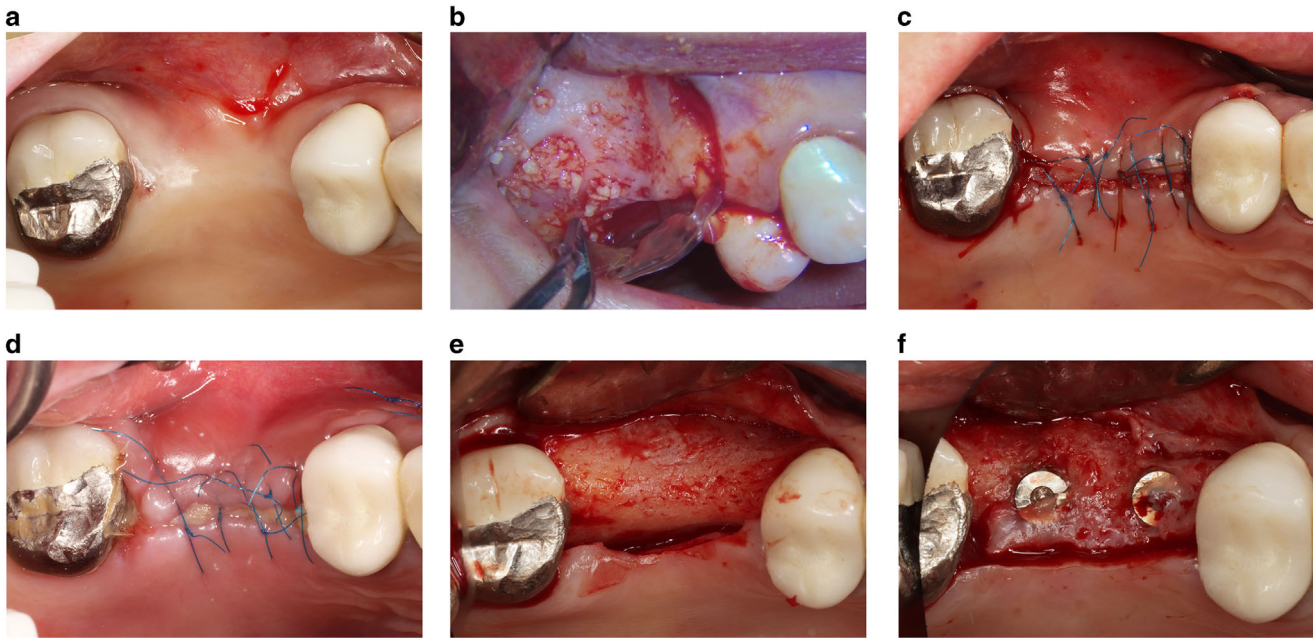


FIGURE 1 **1a** Pretreatment occlusal view of edentulous #3 and #4 site with buccal concavity. **1b** Lateral window sinus elevation was performed, and upon full thickness flap elevation, a defect ≈ 3 -mm horizontal deficiency on the buccal is noted. **1c** The buccal and lingual flap was sutured with a ≈ 2 mm gap left following the open-wound healing concept. **1d** At 1-week postoperative 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. **1f** Three months after implant placement, the two integrated implants were surrounded by sufficient bone and were ready for prosthesis restoration.

with the amnion-chorion membranet. The buccal and lingual flap was sutured with a ≈ 2 -mm gap (Fig. 1c). Postoperative medications included amoxicillin 500-mg three times a day for 7 days, ibuprofen 600 mg Q4 to Q6 hours, and dexamethasone 2 mg with a total of nine 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 (Fig. 1d). An implant surgery was performed 4 months later; the increased bone volume was adequate for standard-sized implant placement (Fig. 1e). After 3 months, the two integrated implants were uncovered with sufficient facial bone thickness (Fig. 1f). See supplementary Video 1 in online *Clinical Advances in Periodontics*.

Case 2

Clinical Presentation/Management and Clinical Outcomes. This patient was a 45-year-old female presented on January 9, 2014 for implant therapy at the mandibular right posterior edentulous ridge with thin alveolar ridge crest (Fig. 2a). Staged GBR was performed on the buccal concavity with intra-marrow penetration, followed by placement ≈ 5 mm in width of the particulate bone allograft[†] covered with two layers of membrane: collagen membranet at the inner surface and amnion-chorion membranet at the outer layer (Fig. 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 (Fig. 2c). The same postoperative regimen as

case 1 was provided. After 4 months, there was ≈ 3 -mm horizontal bone regeneration (Fig. 2d).

Case 3

Clinical Presentation/Management and Clinical Outcomes. This patient presented on March 7, 2019 for implant therapy to replace missing #30. The occlusal view demonstrated a buccal concavity as well as limited keratinized tissue (Fig. 3a). A buccal bony defect was confirmed (Fig. 3b), which was subsequently augmented with the same bone allograft[†] and membranet without complete flap approximation. At 1 week, the membrane could be seen between the flaps (Fig. 3c). Four months after, there was improved buccal ridge contour as well as gain of keratinized tissue (Fig. 3d). There was ≈ 1 -mm facial bone at the osteotomy site (Fig. 3e). See supplementary Video 2 in online *Clinical Advances in Periodontics*.

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

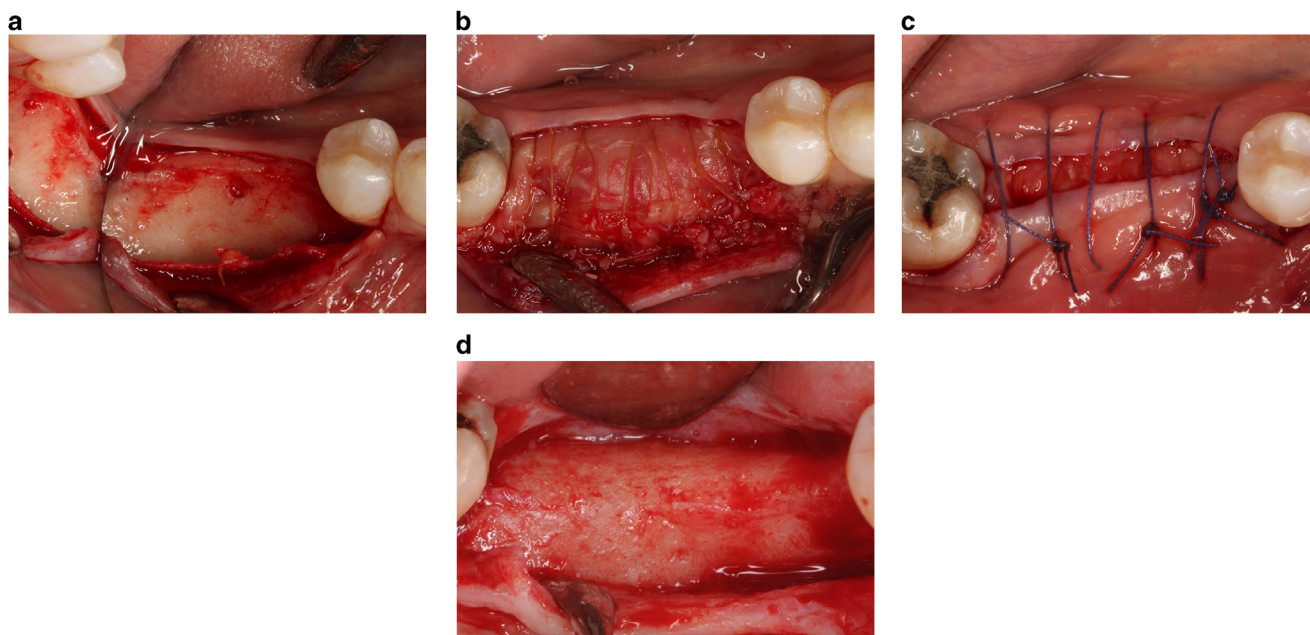


FIGURE 2 **2a** Upon flap reflection, thin alveolar ridge crest and buccal concavity can be noted at the mandibular right posterior edentulous ridge. **2b** GBR was performed with placement of particulate bone allograft covered with two layers of membrane: collagen membrane at the inner surface and amnion-chorion membrane at the outer layer. **2c** A 3-mm 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 \approx 3-mm horizontal bone gain.

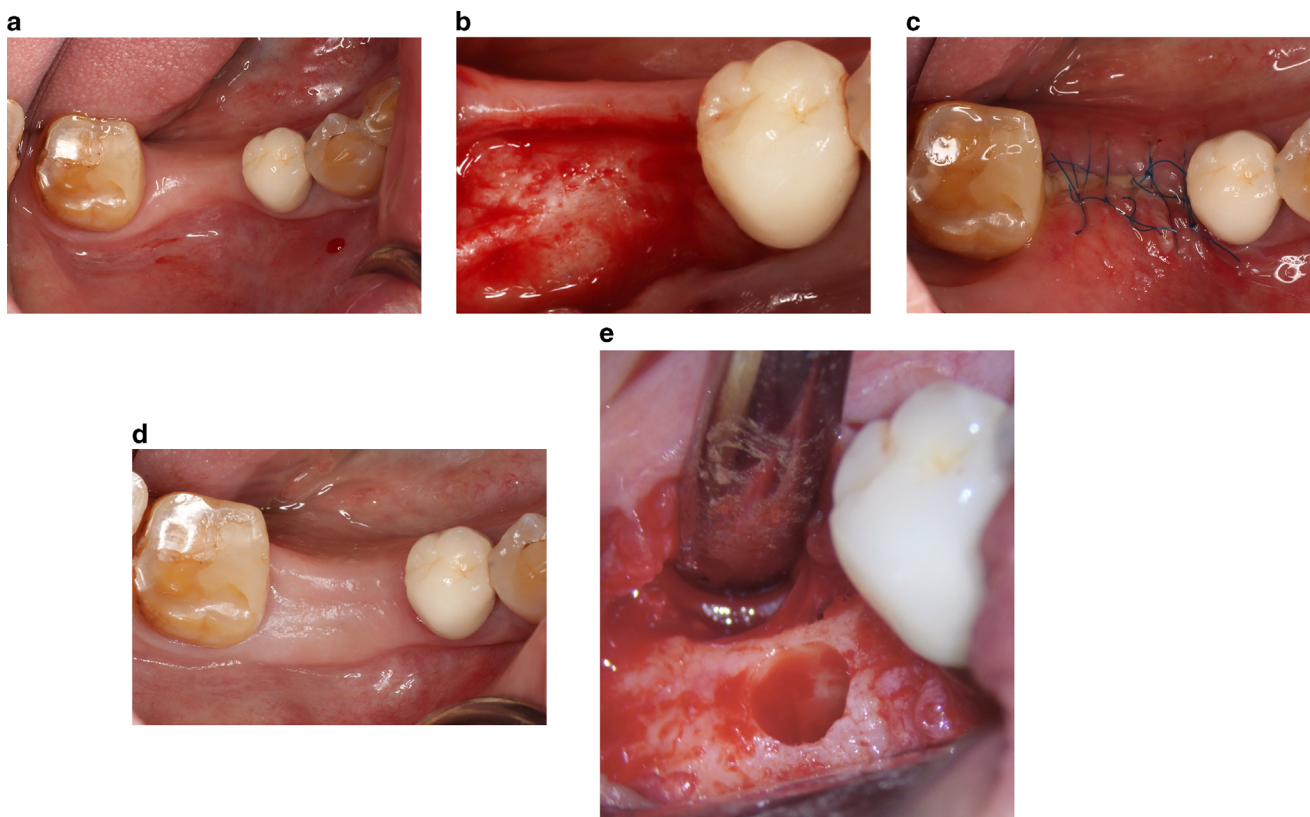


FIGURE 3 **3a** The occlusal view before flap reflection at #30 edentulous site demonstrated a buccal concavity as well as limited keratinized tissue. **3b** Full thickness flaps were elevated, and a buccal bony defect was confirmed. GBR was performed with bone allograft and amnion-chorion membrane without 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.

the wound site, including intact tissue layers and vasculature.¹⁴ The conservative flap manipulation, reflection, and mobilization techniques used in this case series pre-

serve vasculature, decrease soft tissue trauma, and facilitate grafting material stabilization, leading to satisfactory healing at the open-wound 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 to 3 mm) horizontal ridge defects may be treated uneventfully in a controlled open wound healing manner that may allow for reduced surgical trauma, time, and morbidity.

Conclusions

Open wound healing for GBR 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

Why are these cases new information?	<ul style="list-style-type: none"> ■ Instead of utilizing closed wound approach, in certain non-challenging localized and contained horizontal ridge defects, the controlled open wound approach may be applied to reduce trauma, time, and morbidity.
What are the keys to successful management of these cases?	<ul style="list-style-type: none"> ■ Case criteria: Contained localized (2 to 3 mm) horizontal ridge defects could be more predictable ■ Surgical approach: Minimally invasive approach with controlled small open wound ■ Material selection: Bioactive membrane that provides wound scaffold and promotes healing
What are the primary limitations to success in these cases?	<ul style="list-style-type: none"> ■ Unpredictable host healing potential ■ Size and type of the ridge defect ■ Large wound opening ■ Early membrane resorption

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Author Contributions

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. Dr. Chan is a consultant for Snoasis Medical, Denver, Colorado. The other authors report no conflicts of interest related to this case series.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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○ indicates key references.