Amnion–Chorion Allograft Barrier Used on Root Surface for Regenerative Procedures: Case Report

Yusuke Hamada, Yu-Ting Yeh, Steven B. Blanchard

Abstract:

INTRODUCTION:

Guided Tissue Regeneration (GTR) has been well documented with combination of bone graft substitutes and biologic modifiers to improve the outcomes of periodontal regenerative procedures. Amnion-chorion allograft membrane (ACM) is a placenta-derived resorbable allograft membrane which contains growth factors found in the placenta. The primary purpose of the barrier membranes for GTR was to exclude the epithelial down-growth along with the root surface, however, the ACM can be used as an additional biologic modifier due to the release of growth factors from the ACM after placement. The aim of this case report is to evaluate the efficacy and the application of ACM on the previously diseased root surface to treat periodontal intrabony defect.

CASE PRESENTATION:

A 60-year-old Caucasian male with deep and wide intrabony defect on mesial #19 was treated with a regenerative procedure with combination of application of ACM on the root surface and filling the intrabony defect with the corticocancellous freeze-dried bone allograft. The bone substitute was covered with another layer of ACM and primary closure was achieved. Wound healing process was uneventful, and the clinical and radiographic outcomes were favorable up to eighteen months after the surgical procedure.

CONCLUSION:

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This case report demonstrated that the application of ACM on the root surface with a combination of bone substitute might enhance to the radiographic bone fill and the clinical attachment level gain and minimize the risk of post-operative gingival recession.

**Keywords:** Bone regeneration, Periodontal regeneration, Biomaterial(s)

**BACKGROUND:** (293 words)

Intrabony defects associated with deep periodontal pockets represent the apical extension of plaque and its byproducts in the natural course of periodontitis. Regenerative procedures using bone replacement grafts, guided tissue regeneration, biologic modifiers and combination therapies have been shown to be effective in the treatment of intrabony defects. Guided tissue regeneration (GTR) is a procedure designed to regenerate the lost periodontal structures including cementum, periodontal ligament (PDL), and alveolar bone using barrier membranes to allow selective cell repopulation of periodontal surgical sites. Several absorbable barrier materials have been developed including allograft, xenograft, and alloplastic materials. Among these bioabsorbable membranes, the use of placental tissue based allografts in dentistry is a more recent development. Amnion-chorion allograft membranes (ACM) have been reported for use with GTR and root coverage procedures. ACM have biologic properties and growth factors that actively promote wound healing for periodontal defects. Koob et al. demonstrated that ACM possesses an ability to induce the migration of mesenchymal stem cells (MSCs). The cell density of migrated MSCs in response to dehydrated human amnion/chorion tissue allografts was significantly greater than negative control sites such as intact skin and sham-operated sites. These reports support the proposition that ACM should be viewed not only as a barrier membrane but also as a biologically active material containing multiple growth factors and may be of benefit in enhancing
periodontal regeneration. To date, there are no reports on the application of ACM on the previously diseased root surface as a source of biologic modifiers. The purpose of this case report is to evaluate the efficacy and application of ACM placed on the root surface within a periodontal intrabony defect in conjunction with allograft bone substitute using a combination GTR treatment.

**CLINICAL PRESENTATION:** (102 words)

A 60-year-old Caucasian male was referred to Indiana University School of Dentistry Graduate Periodontics Clinic for the periodontal evaluation and treatment in Feb 2017. He was classified as an ASA I, and denied history of smoking habits. Probing depth (PD) on mesial #19 was 10 mm with presence of bleeding on probing. A periapical radiograph showed that the defect reached to the apical third of the mesial root with calculus attachment on tooth #19 (Figs 1, 2). The patient’s O’Leary plaque score was 15% and vitality testing showed #19 was vital. This patient was diagnosed as localized Stage III Grade B periodontitis.

**CASE MANAGEMENT:** (356 words)

The patient received oral hygiene instruction and non-surgical therapy prior to referral to our clinic. Based on the diagnosis and limitation of the non-surgical periodontal therapy, the patient opted to proceed with a regenerative procedure to treat the intrabony defect on the mesial of tooth #19. Prior to the surgical procedure, the patient signed the informed consent and authorization forms. Following administration of local anesthesia (2% lidocaine with 1/100,000 epinephrine), a sulcular incision on the buccal and lingual aspects on the area was made, and full-thickness flaps were reflected. The defect was debrided to remove granulation tissue and
thorough scaling and root planing was performed. A wide and deep 2 wall intrabony defect extending to buccal surface of #19 (approximately 3mm in width, 4 mm in depth from the buccal wall and 8 mm in depth from the lingual wall) was present (Fig 3). A 17% EDTA solution was applied on the root surface with cotton pellets for 2 minutes. A 25x15 mm ACM‡ was cut in half, and one half was placed on the root surface first as a biologic modifier. The most coronal portion of the membrane extended ~3mm coronal to the cement-enamel junction (CEJ). After this membrane was placed, a drop of saline was applied to obtain better adaptation of membrane along the root surface (Fig 4). Freeze-dried bone allograft§ (FDBA) was then placed in the intrabony defect (Fig 5) and the coronal portion of membrane along the root was folded over the graft materials which was then covered by the remaining piece of ACM (Fig 6). The flaps were sutured with 5-0 polytetrafluoroethylene (PTFE)∥ and primary closure was achieved (Fig7). This patient was prescribed 875mg amoxicillin twice a day for seven days and ibuprofen 600mg three times a day for three days. The patient rinsed twice daily with 0.12% chlorhexidine for 2 weeks after surgery and was instructed to refrain from brushing the teeth in the area for 2 weeks.

**CLINICAL OUTCOME:** (123 words)

Overall post-surgical wound healing was uneventful. Two months after the completion of surgery, tooth #19 showed 3mm of recession on the mesial aspect with slight loss of papillary height (Fig 8). At 6 months post-operatively, the clinical examination revealed that the PD was reduced from 10 mm to 4 mm and the post-surgical recession was reduced to 0.5 mm (Fig 9). Clinical examination revealed that the interdental papillae slowly grew back to the pre-treatment

‡ BioXclude® membrane, Snoasis Medical LLC, Golden, CO, USA
§ Particle size of 0.25-0.5mm of corticocancellous blend, Maxxeus®, Kattering OH, USA
∥ PTFE 5/0 Suture Extra cutting needle 3/8, Omnia LLC, Abbottstown, PA, USA
level and the PD was stable with 4 mm PDs without bleeding on probing (BOP) at 18 months post-surgically (Fig 10). Bone fill in the defect was confirmed with a radiographic examination at 6 months, then the bone fill was stable at 18 months after the procedure (Figs 11-12).

**DISCUSSION:** (462 words)

This case report demonstrates the efficacy and safety of application of ACM along the root surface in the treatment of an intrabony defect. Earlier studies have investigated the biological properties of ACM, and the results revealed that ACM retains platelet-derived growth factor-AA (PDGF-AA), PDGF-BB, transforming growth factor α (TGF-α), TGF-β, fibroblast growth factor (FGF), epidermal growth factor (EGF), and IL-4, 6, 8, and 10, and tissue inhibitors of metalloproteinases (TIMPs) which enhances cell proliferation, angiogenesis, inflammation, metalloproteinase activity and recruitment of progenitor cells. 10, 11 The resorption time of ACM is approximately eight to twelve weeks once fully covered with a flap. However, the time point and the peak of the growth factor release from ACM during the resorption are not fully understood.

Kiany and Moloudi 14 reported results of a randomized clinical trial comparing the ACM with deproteinized bovine bone mineral (DBBM) versus a collagen membrane (CM) with DBBM for the treatment of intrabony defects. Both groups showed improvement of clinical periodontal parameters. Post-operative gingival recession showed a significant increase in the CM group but not in the ACM group. The authors stated that the high concentrations of laminin-5 in the ACM, with its high affinity for gingival epithelial cells, could accelerate healing and integration of the membrane with gingival tissue, thereby minimizing post-operative recession. In addition, one of the major advantages of ACM compared to other resorbable membranes is its thinness.
(approximately 320µm) and good adaptability. Since the mechanical property of ACM for space
maintenance may not be preferable for non-containable defects, FDBA was utilized with a
combination of ACM instead of demineralized freeze-dried bone allograft (DFDBA). 15 We
hypothesized that the application of the ACM directly along the root surface within a periodontal
defect has the potential to enhance healing due to release of growth factors within the healing
wound in addition to its use as a barrier membrane. In the present case report, significant defect
resolution and radiographic bone fill was seen at 6 months and remained stable up to 18 months.
Additionally, the 3 mm of gingival recession that was noted 2 months post-surgically decreased
to 0.5mm at 6 months by soft tissue maturation and coronal migration. Based on the authors’
knowledge, this case is the first to illustrate this phenomenon in a regenerative procedure around
natural tooth with the combination of FDBA and ACM. The biological properties of this material
are probably contributing the soft tissue attachment and maturation as additional benefits to the
conventional GTR procedures. The ACM membrane was used for two purposes, one as potential
reservoir for growth factor release and secondly as a barrier membrane as a cost-effective
measure for the treatment of intrabony defects. Well design randomized clinical trial will be
needed to confirm the favorable outcomes in this case.

SUMMARY

| Why is this case new information? | This case report demonstrated that the application of ACM on the root surface with a combination of bone substitute contributed to the radiographic bone fill and the clinical attachment level gain and minimize the risk of post-operative gingival recession. |
What are the keys to successful management of this case?

Patient systemic condition and local factors including non-smoker, good compliance for maintenance protocol, and thick gingival tissue around the site contributed to the favorable outcomes.

What are the primary limitations to success in this case?

Due to the lack of the biopsy and histological analysis, the healing pattern of the periodontal apparatus such as periodontal regeneration or new attachment remains unknown.

Acknowledgments

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REFERENCES


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Figure 1. Initial clinical presentation on buccal of #19 with 10mm PD.

Figure 2. The initial radiograph demonstrated deep vertical bone loss on #19 with the presence of calculus.

Figure 3. A wide and deep 2 wall intra-bony defect involved the buccal surface of mesial root of #19.

Figure 4. ACM application on the root surface. Entire exposed root surface was covered and the most coronal portion of the membrane was placed >3mm coronal of cement enamel junction.

(Exemplary Figure)

Figure 5. The FBDA particles did not exceed the edge of defects in order to avoid the overfill.

Figure 6. The coronal first membrane was folded over the graft materials and the additional layer of ACM covers all the bone substitutes and the part of root surface.

Figure 7. Primary closure with 5-0 PTFE sutures in interrupted techniques.
Figure 8. Two months post-surgical procedure showed approximate 3mm of the gingival recession on mesial of #19.

Figure 9. Six months follow-up after the surgical procedure. The gingival recession reduced to 0.5 mm from 3 mm.

Figure 10. Eighteen months after the procedure showed soft tissue maturations and reduction of gingival recession. PD remained 4mm without BOP.

Figure 11. Six months post-operative vertical bitewing demonstrated the bone fill in the area.

Figure 12. Eighteen months (1.5 years) post-surgical radiographs showed the stability of bone level following over time. (Exemplary Figure)