

Intentional Exposure of Barrier Membranes In Ridge Preservation Procedures:

Clinical, Radiological, and Histological Comparison of Amnion-Chorion with Dense PTFE

Muyeenu Hassan, BDS, MSD, Steven B. Blanchard, DDS, MS, Sivaraman Prakasam, BDS, MSD, PhD
Department of Periodontics and Allied Dental Programs, IUSD, Indianapolis, Indiana

Abstract

Aim

To compare the effectiveness of the resorbable amnion-chorion membrane (ACM) with dense polytetrafluoroethylene membrane (d-PTFE) in site preservation procedures, where the membranes are intentionally left exposed in the oral cavity without primary closure.

Methods

Subjects undergoing non-molar extractions participated in this randomized split-mouth study. Ridge dimensions were measured clinically and radiographically at baseline and 3 months post-operatively. After extraction, sockets were grafted with a 70/30 mineralized/demineralized allograft bone blend (Maxxeus™, Community Tissue Services). In each subject, membranes were randomly allocated to opposite sides of the same arch and were left exposed to the oral cavity. Subjects recorded post-operative discomfort on each side with a visual analog scale (VAS). Three months later, bone core samples were collected for micro-CT (μCT) and histological analysis. Statistical significance was tested using fixed effect ANOVA.

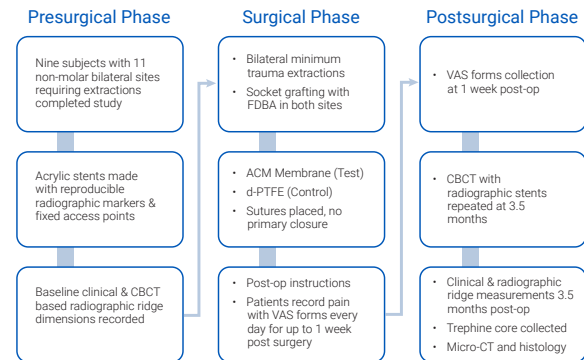
Results

Twenty-two sites in nine subjects were evaluated. Three-month post-operative changes in clinical ridge width; radiographic ridge width at 1mm, 3mm and 7mm apical to the relative alveolar crest, were not significantly different between ACM (BioXclude®, Snoasis Medical) and d-PTFE sites. Vertical ridge measurements revealed a mean bone gain with ACM in the central, mesial and distal plane measuring +0.24 mm, +0.47 mm and +0.64 mm respectively and a mean bone loss with d-PTFE measuring -0.26 mm, -0.14 mm and -0.39 mm, respectively but this difference was not statistically significant. μCT analysis of bone cores revealed significantly more bone volume present in ACM sites (P=0.017). Histological analysis did not reveal any significant difference between the groups. Sites treated with ACM had significantly less VAS scores as compared to d-PTFE on post-operative days 1 (p=0.0001) and 2 (p=0.017).

Conclusions

The results indicate that ACM was as effective as d-PTFE in preserving ridge dimensions in non-molar extraction sites even when left exposed in the oral cavity. ACM provides the additional benefit of reduced post-operative discomfort which may be related to its inherent biological properties.

Materials and Methods



Background

Ridge preservation procedures minimize the substantial alveolar ridge resorption that occurs after dental extractions. They often involve the use of bone grafts, barrier membranes, and flap advancement for primary closure.

- Flap advancement requires additional surgical maneuvers that add time and may increase likelihood of post-operative morbidity.
- Placental membranes have been used as wound dressing for burns and skin ulcerations and as a patch in ocular surgery.
- Amnion-chorion membrane (ACM) is a biologically active Purion™ processed placental allograft with inherent abilities to modulate inflammation and angiogenesis; promote faster wound healing; and reduce early post-operative discomfort.

Results

Fig 1: Clinical Measurements (Ridge Width)

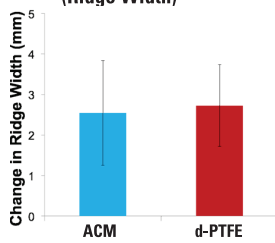


Fig 2: Radiological Ridge Width Resorption

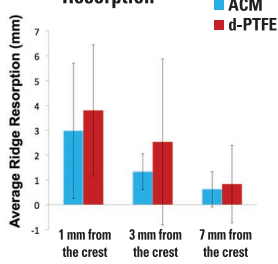


Fig 3: Radiological Measurements (Ridge Height)

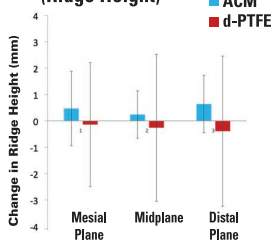


Fig 4: Histological Analysis

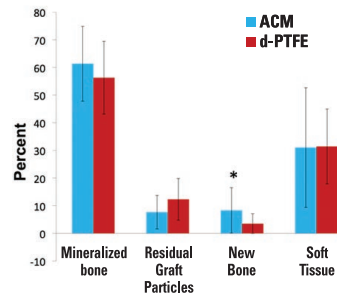


Fig 5: Micro-CT Analysis

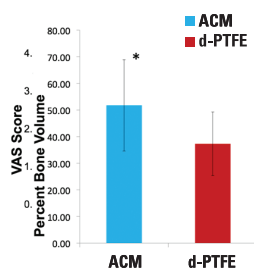
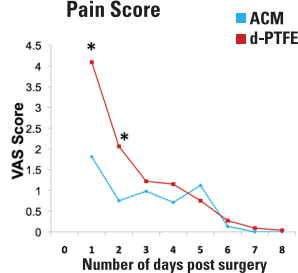


Fig 6: Visual Analog Scale Pain Score



*Statistically significant

Fig 7: Micro-CT

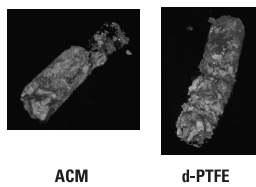
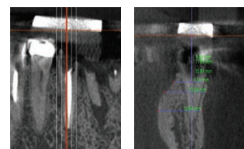
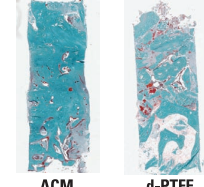


Fig 8: Histology



References

- Heggeler et al. Effect of socket preservation therapies following tooth extraction in non-molar regions in humans: a systematic review.
- Velez I, et al. Cryopreserved Amniotic Membrane for Modulation of Periodontal Soft Tissue Healing: A Pilot Study. J Periodontol 2010; 81:1797-1804.
- Koob TJ, et al., Properties of dehydrated human amnion/chorion composite grafts: Implications for wound repair and soft tissue regeneration. J Biomed Mater Res B Appl Biomater. 2014 Aug;102 (6) :1353-62.

Summary of Results

Parameters	ACE	d-PTFE	P Value
Clinical - Mean change in ridge width ± SD (mm)	2.57 ± 1.29	2.7 ± 1.00	0.7196
Radiographic - Mean change in ridge width ± SD (mm)			
at 1 mm from relative crest height	2.98 ± 2.72	3.80 ± 2.64	0.3355
at 3 mm from relative crest height	1.33 ± 0.73	2.53 ± 3.34	0.1613
at 7 mm from relative crest height	0.62 ± 0.71	0.83 ± 1.56	0.8025
Radiographic - Mean change in ridge height ± SD (mm); (+) Bone gain; (-) Bone loss			
at mesial plane	(+) 0.47 ± 1.41	(-) 0.14 ± 2.35	0.45217
at mid plane	(+) 0.24 ± 0.90	(-) 0.26 ± 2.79	0.61197
at distal plane	(+) 0.64 ± 1.09	(-) 0.39 ± 2.85	0.30686
Micro CT - Bone volume percent (BV/TV) ± SD; (n+10)	55.14 ± 14.15	39.70 ± 9.80	0.0174*
Histology - (Mean SD)			
% Mineralized bone	61.31 ± 13.53	56.27 ± 13.14	0.438
% Residual graft particles	7.67 ± 6.08	12.31 ± 7.54	0.171
% New bone	8.31 ± 8.20	3.50 ± 3.59	0.24
% Soft tissue	31.02 ± 21.64	31.42 ± 13.50	0.847
Visual Analog Scale - Mean Post-operative pain scores ± SD			
Post-op day 1	1.82 ± 1.57	4.09 ± 2.70	0.0001*
Post-op day 2	0.76 ± 0.96	2.02 ± 1.94	0.0171*

***Statistically significant**

- Ridge width measurements showed no statistically significant difference between the two sites.
- Ridge height measurements showed mean bone gain in ACM sites and mean bone loss in d-PTFE sites but it was not statistically significant.
- Histology showed more mineralized and new bone, less residual graft, and similar amount of soft tissue at ACM sites when compared to d-PTFE sites. These differences were not statistically significant except for new bone formation.
- Micro-CT analysis showed significantly more bone volume percent at ACM sites.
- ACM sites had significantly less VAS pain scores as compared to d-PTFE sites on post-operative days 1 and 2.

Discussion

- Even though, both membranes were left exposed, ridge width changes noted here were within the range of 1.8 - 3.5 mm as reported by previous "traditional" site preservation studies¹.
- Pain scores - consistent with previous study², which used cryopreserved (and not dehydrated) amnion - possibly due to 'initial burst release' of numerous soluble mediators³.
- Remodeling of ACM - gradual release of the growth factors - faster mineralization and continued bone formation³.

Conclusions

Within the limitations of this study, results indicate that ACM appears to preserve ridge dimensions as effective as d-PTFE even when left exposed in the oral cavity.

In addition, ACM sites resulted in less discomfort when compared to d-PTFE sites at 72 hours postoperatively.

