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Decellularized Dermis Allograft

Treatment of Human Gingival Recession Defects With Decellularized Dermis Matrix and Enamel Matrix Derivative Using Coronally Advanced Flaps.

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**Key findings in this study were significant root coverage and clinical attachment
from treatment of gingival recessions with a new acellular dermis material
combined with Emdogain.**

ABSTRACT:

Background: Gingival recession is prevalent in the general population and creates problems with sensitivity, root caries and esthetics. The technical challenge presented by tunneling techniques with acellular dermis matrix to treat recession sites limits its utilization. There is limited evidence in the literature on the results obtained from treating human recession sites with a combination of acellular dermis matrix (ADM) and enamel matrix protein derivative (EMD). The purpose of this case series is to document the results from using a coronally advanced flap (CAF) technique with enamel matrix protein derivatives and acellular dermis matrix to treat Miller Class I and II recession sites.

Methods: Twenty sites with Miller Class I or II recession were randomly selected for treatment with CAF over EMD and ADM. Clinical measurements were made and recorded at baseline and 3 months, recording recession depth, keratinized tissue width and clinical attachment level for each site.

Results: The mean recession decrease was $2.5\text{mm} \pm 0.7\text{ mm}$. The mean percentage root coverage was $94.7\% \pm 8.6\%$. The mean gain in clinical attachment was $3.2\text{ mm} \pm 1.1\text{ mm}$. The mean gain keratinized gingiva width was $0.9\text{ mm} \pm 0.5\text{ mm}$ with a range of 0.5 mm to 2.0 mm.

Conclusions: Based on the results recorded at 3 months, there was significant gain in root coverage, gain in clinical attachment and increase in width of keratinized gingiva for all recession sites treated with CAF over EMD and ADM.

Key Words: Gingiva, recession, attachment loss, surgical flap, root

INTRODUCTION:

Gingival recession is found in approximately 25% of the general population¹. When gingival tissue recedes past the cemento-enamel junction, it can lead to root sensitivity, root caries and esthetic issues. Numerous techniques have been used to treat recession and attachment loss. These include laterally positioned flaps², free gingival grafts³⁻⁵, subepithelial connective tissue grafts(SCT)⁶, barrier membranes⁷⁻⁹ and acellular dermis matrix (ADM).¹⁰⁻¹² SCT grafts have been referred to as the “gold standard” for recession treatment surgery.¹³

The 1996 review of multiple root-coverage techniques by Wennstrom¹⁴ reported root coverage using SCT grafts ranging from 50% to 98%, with an average of 89%. Others reported 97% root coverage with 88% of sites exhibiting total root coverage.¹⁵ So, varying results are seen with SCT grafts in published studies. The coronally advanced flap procedure alone is frequently able to achieve complete root coverage and clinical attachment gain. However, an 8-year follow up study of CAF surgery cases by Pini-Prato et al. showed recession relapse and reduction in width of keratinized tissue.¹⁶

SCT grafts require a second surgery to harvest tissue from the palate, they produce increased morbidity and require additional surgery time for treatment of recession sites. The amount of connective tissue that can be harvested from the palate is limited, so patients that have multiple recession sites to treat may require repeated surgeries.¹⁷ These considerations make using a suitable donor tissue a highly desirable goal.

ADM provides a substitute for harvested tissue, and¹⁸ was originally developed for treatment of burn patients.¹⁹ ADM has the epidermal layer and all cellular components removed, so rejection response is not an issue. It acts as a scaffold for the ingrowth of fibroblasts and endothelial cells into the collagen matrix. A review of multiple studies by Gapski comparing ADM with SCT grafts, free gingival grafts and advanced flap procedures reported equivalent results in root coverage, probing depth reduction, keratinized tissue formation and clinical attachment level increase.²⁰ Histologic results from other studies showed similar attachment to root surfaces between ADM and connective tissue grafts after 6 months. After 10 weeks, the ADM is turned over and replaced by ingrowth of connective tissue and epithelial tissue, with no inflammatory cells observed.²¹

EMD used with CAF has been shown in multiple studies to significantly increase root coverage, clinical attachment gain and keratinized gingiva compared to CAF without EMD.²⁴⁻²⁶ Pourabbas, in one of the few studies found combining EMD and ADM, reported on the combined use of EMD, ADM and CAF. Positive results were shown in root coverage gain, increase in clinical attachment and increased width of keratinized gingiva.²⁷ The studies reviewed suggest that combining ADM and EMD would likely have a synergistic effect in providing root coverage, increased gingival attachment and increased keratinized gingiva.

The purpose of this case study is to document the results from use of a new decellularized dermis matrix in combination with EMD with vertical releasing incisions to coronally advance flaps in the treatment of Miller Class I and II recession defects.

METHODS AND MATERIALS:

This case series was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000. All patients received verbal and written instructions for home care and signed a consent form before surgery. Selection criteria included: patients 18 years of age or older, no active periodontal

disease, non-smokers, no uncontrolled diabetes, no history of systemic conditions that could interfere with normal healing and recovery, Miller Class I and II recession. Sites treated were selected randomly for treatment with acellular dermis matrix (*Salvin Dental Specialties, Charlotte, NC*) and enamel matrix derivative (*Emdogain, Straumann LLC, Andover, MA*). All measurements and treatment were done by the same clinical investigator. A North Carolina periodontal probe was used to record measurements to the nearest 0.5 mm. Recession was measured from the CEJ to the midfacial gingival position. Clinical attachment was measured from the CEJ to the midfacial probing depth. Width of keratinized gingiva was measured from the midfacial gingival margin to the mucogingival junction.

Each patient was draped and the face scrubbed with povidone iodine 7.5%. Each surgery was done with monitored intravenous anesthesia using an automatic pulse oximeter displaying heart rate, electrocardiogram, oxygen saturation, and blood pressure. 1.0 gram of cefazolin for injection was diluted with sterile water for injection and placed into a 500 cc sterile 0.9% saline bag, unless cephalosporin sensitivity was reported. In this event, 200 mg of intravenous ciprofloxacin was placed in the 500 cc i.v. solution. 8 mg of i.v. dexamethasone was added to the i.v. solution. All of the i.v. fluid was given to administer the steroid and antibiotic contents. An intravenous line was obtained with a 23 gauge butterfly needle and infusion was continuous with 500 cc 0.9% saline. Sedation was initiated with intravenous administration of 50 mg. diphenhydramine, followed by 50 mg of meperidine and administered. Midazolam 5mg/cc and propofol 10mg/cc were given by titration to induce and maintain the desired level of conscious sedation. 2% lidocaine with 1:100,000 epinephrine was infiltrated for local anesthesia.

SURGICAL PROCEDURE:

In each recession site sulcular releasing incisions were made with a #15-c blade (*Hu-Friedy Corporation Chicago, IL*), and extended at least one tooth past the surgery site going diagonally and obliquely across papillas where interproximal beveled vertical releasing incisions at line angle positions were used. The facial epithelium of each papilla was removed with the 15-c blade or rotary instrument to promote reattachment of the flap. Split-thickness flap dissection with vertical releasing incisions was extended a minimum of 10 mm apical to the crest of facial supporting bone. Full-thickness periosteal release was used to have tension-free flap closure over the ADM. Root surfaces were thoroughly planed with fine round diamonds and Rhodes back-action chisels* to remove any surface contaminants and to flatten the facial contour. The sites were then treated with ethylenediaminetetraacetate (EDTA) for 1 minute and rinsed with sterile saline. EMD was applied to cover treated root surfaces just prior to placement of the allograft. ADM approximately 1.0 mm in thickness, were rinsed in sterile saline to remove the preservative medium. The ADM was cut to approximately 10 mm by 10 mm for single sites to extend to the interproximal line angles mesially and distally to each site, and extending apically to cover at least 5 mm of facial alveolar bone. The ADM was placed at the level of the CEJ and secured by interrupted 6-0 polygalactin suture (*Vicryl, Johnson and Johnson Corporation, Somerville, NJ*) placed through the papillas individually to minimize movement of the membrane after surgery. Sling sutures were then placed over each ADM site beginning lingually or palatally and extending through the periosteum and vestibular tissue at the depth of the dissection. This was done to prevent micro-movement of the ADM and clot disruption during healing. Flaps were closed with internal mattress sling sutures using 6-0 polypropylene (*Prolene, Hu-Friedy Inc. Chicago, IL*) to coronally advance them so as to completely cover the ADM. Interrupted 5-0 chromic gut sutures were used to secure the flap closely to each papilla. Light pressure was applied to each site after suturing to adapt the flap closely and achieve hemostasis. Medicines prescribed after the surgery were 0.12% chlorhexidine gluconate (*3M Center Building 275-2SE-03 St. Paul, MN*) antibacterial rinses twice daily, cephalosporin 500 mg oral capsules, one three times daily, and as needed for discomfort. Post-surgical instructions emphasized taking care not to disturb the healing sites. Soft brushes were given to use over the treated sites before suture removal. Sutures were

removed at 2 weeks. Follow-up visits were at 6 weeks and then at 4 months for recording of clinical measurements. Oral care technique was reviewed at post-surgical visits to reinforce atraumatic brush use to prevent disruption of the healing grafted sites.

RESULTS:

Five subjects were 3 males and 7 females ranging in age from 26 to 66 years. Twenty sites were treated, none being molars. At 3 months the mean percentage of root coverage was 91.2% with a mean decrease in recession of 2.4 mm. Mean clinical attachment gain was 3.2 mm, and increase in width of keratinized gingiva was 0.9 mm.

Table I: Comparison of Clinical Parameters at Baseline and 3 Months

| Parameter | Change at 3 Months |
|-----------------------------------|--------------------|
| Recession decrease (mm) | 2.5 ± 0.7 |
| Root coverage (%) | 94.7 ± 8.6 |
| Clinical attachment gain (mm) | 3.2 ± 1.1 |
| Probing depth decrease (mm) | 0.8 ± 0.6 |
| Keratinized gingiva increase (mm) | 0.9 ± 0.5 |

No adverse effects were reported or observed, no acellular dermis matrices were lost or exfoliated, and all subjects completed the study interval.

DISCUSSION:

Results of this limited case series using CAF with vertical release over ADM and EMD suggest this is an effective treatment method for gingival recession. Blood supply is a significant factor in gaining favorable results from recession graft surgery, and it has been suggested that not using vertical incisions for flap release is important.²⁸ However, others authors have opined that using vertical releasing incisions does not negatively impact blood supply.²⁹

Tunneling is a surgery technique that has been advocated with acellular dermis in the past.³⁰ It is technically difficult and requires significant surgical time for the treatment of a limited number of teeth. Papageorgakopolus showed less root coverage with tunneling than with coronally advanced flaps; coronally advanced flaps produced defect coverage of 95%, while the tunnel technique produced 78% defect coverage.³¹ In view of the difficulty with tunneling and extensive time required, other technique options are desirable. Most recession sites are treatable with acellular dermis matrix non-tunneling technique, instead of harvested subepithelial connective tissue or free gingival grafts. The primary exception to this, in our experience, is the mandibular anterior teeth. This anatomic region has thin tissue, lack of vestibular depth and presents difficulty for clinicians in attaining passive flap release adequate to cover ADM. In other sites, CAF with vertical release over ADM offers the advantages of shorter surgery time, less morbidity due to not having a second surgery site for graft tissue harvest and the ability to treat multiple sites during one surgery.³²

There is a learning curve with ADM as with any technique new to a clinician, but we feel the significant advantages of ADM outweigh the technique sensitivity and learning curve involved. Among the factors

that are important in achieving predictable results are tension-free flap advancement accomplished by extending the split thickness dissection apically and spreading periosteal tissues with scissors, and by using a vestibular periosteal release. This is an important step to prevent pull-back of the flap and prevent exposure of the ADM.³³ Blood supply to the ADM graft is enhanced by split-thickness flap dissection as it preserves the blood supply from the periosteum.³⁴ Minimizing movement of the ADM and preventing clot disruption can be accomplished by using periosteal mattress sling suturing from the base of the vestibule, passing over the ADM through the interproximal space and anchoring around the teeth.

No additional periodontal stabilizing material was used over the sutured sites. Multiple companies offer acellular dermis matrices processed in different ways and of varying size and thickness. Some products require sterile saline hydration, while others are ready to use immediately, so these factors can come into play when a spontaneous decision is made to use ADM in a surgery.

The consistent findings using ADM combined with EMD in the technique described are increased root coverage, coverage of carious root lesions, reduced root sensitivity, increased width of keratinized gingiva and increase in clinical attachment.

A larger number of sites in a future study would be needed to ascertain the predictability of the results shown in this case series.

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Decellularized Dermis Allograft

Photos By Dr. Stephen C. Wallace, M.H.S., Wilmington, NC



Presurgery - Front



Presurgery - Right



Presurgery - Left



Acellular Dermis Placed



Suture Closing



3 Month Post-Surgery

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