EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 8
Issue: 3
138-141
Year: 2021

ACELLULAR DERMAL MATRIX

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DOI: https://doi.org/10.17605/OSF.IO/TX4SM

Article Received on 04/01/2021 **Article Revised on 25/01/2021** **Article Accepted on 15/02/2021**

INTRODUCTION

Langer and Langer (1982) introduction of subepithelial connective tissue graft (CTG) has made periodontal plastic surgery highly predictable and very esthetic with less morbidity, pain and post-operative problems. The SCTG has become the foundation on which modern periodontal plastic surgery is built. However, SCTG has got its own disadvantages. Recently, a new allographic acellular dermal matrix was introduced under the commercial name "AlloDerm" by Life Cell Corporation and Bio Horizons. Initially introduced in 1994 for treating burn patients, AlloDerm has proved its versatility and safety in diverse procedures in general, orthopedic, urogenital and dental surgeries.[1]

DISADVANTAGES OF SCTG

Though SCTG gives excellent predictable results, it has got its own disadvantages.

- Second surgical site
- Difficult in areas of multiple recession
- Limited donor tissue.
- Increased morbidity
- Increased pain
- Delay in treatment owing to healing
- Increased chair time
- Increased patient anxiety
- Decreased patient acceptance

Acellular Dermal Matrix

AlloDerm is an acellular dermal matrix derived from donated human skin that undergoes a multi-step proprietary process that removes both the epidermis and the cells that can lead to tissue rejection. AlloDerm has been used in a wide variety of soft tissue grafting procedures such as root coverage, soft tissue augmentation and guided bone regeneration with a consistent record of excellent results. AlloDerm offers numerous advantages compared to the connective tissue autograft from the patient's palate.[2]

Advantages of Acellular Dermal Matrix

- Eliminates the need for palatal surgery
- Removes palatal harvesting limitations from treatment planning considerations
- Reduces patient reluctance to follow through with surgical treatment
- Consistent quality
- Provided in multiple convenient sizes and thickness
- Ease of handling
- Handles similarly to connective tissue
- To treat single or multiple sites
- Highly predictable
- Highly esthetic

Procurement and Processing

AlloDerm owes its exemplary safety to the safeguards at every step starting from donor screening to the final packaging. The tissues accepted only from AATB (American Association of Tissue Banks) compliant tissue banks are used in processing. Extensive panel of

serology testings are done. Proprietary processing technology removes immunogenic cells and minimizes risk of disease transmission. Final sterility testing ensures that no external pathogens are introduced while processing. The proprietary processing to derive AlloDerm from donor tissue involves treatment with buffered salt solution to separate and eliminate the epidermis. Later, series of washes with mild non-denaturing detergent solutions to solubilize and eliminate all cells were done. Final freeze drying step uses a patented technology that prevents damaging ice crystal formation.[2]

Supply and Storage

AlloDerm is supplied on a printed paper backing and is sealed in an inner (Tyvek) pouch, which is enclosed within an outer foil bag. Product thickness range and size are clearly marked on the label located on the outer foil pouch. The ADM should be stored at room temperature. The expiration date for the product is recorded on the product container labeling as year (4 digits) and month (2 digits) and the product expires on the last day of the month indicated. Expiration date printed on the labeling is valid as long as product is stored at room temperature and in an unopened foil bag.[3]

Healing Mechanism

AlloDerm (ADM) provides a matrix consisting of collagens, elastin, vascular channels, and proteins that support revascularization, cell repopulation and tissue remodeling. After placement, the patient's blood infiltrates the AlloDerm graft through retained vascular channels, bringing host cells that adhere to proteins in the matrix. Significant revascularization can begin as early as one week after implantation. The host cells respond to the local environment and the matrix is remodeled into the patient's own tissue, in a fashion similar to the body's natural tissue attrition and replacement process. AlloDerm is an aseptically prepared biocompatible graft material that acts as a biological regenerative matrix or scaffold for the ingrowth of primordial undifferentiated mesenchymal and endothelial cells (7days). Because no gamma radiation is used and freeze drying does not physically damage the collagen bundle structure or the basement membrane complex or the interstitial glycosaminoglycans, including hyaluronic acid and chondroitin sulphate, the collagen matrix and basement membrane complex are left intact.[3]

It thus permits normal cell migration, repopulation (14-21 days), and incorporation and maturation (4-5 weeks).[4] The turnover and replacement is by the fibroblast. There is no foreign body or gaint cell reaction or residual by-products to interact, inhibit or alter the normal biologic process of collagen production and removal. ADM is also an immunologically inert material because it is cell free. It thus lacks the MHC class I and class II antigens required for antigenicity, rejection and inflammation and the cellular elements required for viral transmission.[5]

Direction of Usage

Do not sterilize alloderm. When preparing to use AlloDerm in the operating room, the following rehydration procedure should begin early enough to allow for adequate rehydration prior to intended implantation. For best results when rehydrating AlloDerm, use liberal amounts of warmed saline solution in a two-step bath with light agitation. Normal rehydration of AlloDerm is usually accomplished in 10-40 minutes, depending on thickness.[6]

Equipment required

1. Two sterile dishes large enough to accommodate the AlloDerm without bending
2. Sterile normal saline or sterile lactated Ringer's solution that is sufficient to completely submerge the graft.
3. Sterile atraumatic forceps

Rehydration Step

- Tear open the foil bag at the notch and remove the inner (Tyvek) pouch. (Keep both the foil bag and inner (Tyvek) pouch out of the sterile field.)
- Peel open the inner (Tyvek) pouch and aseptically remove the tissue. Do not peel printed paper backing at this point in the process.
- Submerge the tissue completely and soak for a minimum of 5 minutes or until the backing separates from the AlloDerm.
- Warming saline up to 37°C and using gentle movement of AlloDerm in the solution speeds the rehydration process. However, do not heat saline above 37°C.
- When rehydrating multiple pieces, ensure the pieces are not overlapping or clumping together as this may slow down the process. Use multiple bowls if necessary.
- Keep AlloDerm fully submerged by weighing it down, e.g., with sterile forceps.
- If you are having a problem with rehydration, gently wipe/rub both sides of AlloDerm, with a sterile gloved hand, to remove any excess cryoprotectant that may be creating a barrier between the AlloDerm and the rehydration fluid.
- Using a sterile gloved hand or forceps, remove and discard the backing once it separates from the tissue. Then, aseptically transfer the tissue to a second bath sufficiently filled with rehydration fluid.
- Submerge completely and soak until the tissue is fully rehydrated (thicker grafts may take up to 40 minutes). Keep AlloDerm fully submerged by weighing it down, e.g., with sterile forceps.
- When AlloDerm is fully rehydrated, it is soft and pliable throughout. At this stage, it is ready for application to the surgical site. AlloDerm may be aseptically trimmed to required dimensions.

- Use AlloDerm within 4 hours of rehydration. If not completely rehydrated, AlloDerm will appear to be of uneven thickness and have a mottled appearance.
- Animal studies have shown that implanting dry AlloDerm induces a mild inflammatory response. Antibiotics may be added to the second rehydration solution
- The cryoprotectant that enables freeze-drying of dermis without structural damage may be toxic if exposed to cell an high-concentrations. So, 10 minutes of rehydration is required. The excess cryoprotectant may be removed by gently wiping/rubbing both sides of AlloDerm with a sterile gloves.[7]

Orientation and adapation

AlloDerm has two distinct sides, the "dermal" side and the "basement membrane" side (Table 1). The dermal side is shiny, smooth, and absorbs blood. The basement membrane side is rough, dull, and repels blood. When applied to the wound bed in a grafting procedure, the dermal side should be placed against the wound bed, with the basement membrane side facing up. When applied as an implant, the dermal side should be placed against the most vascular tissue. Using a sterile gloved hand or forceps, the rehydrated AlloDerm graft is transferred to the wound bed. After correct orientation, the AlloDerm may be further trimmed to desired dimensions. Apply firm pressure on the AlloDerm graft with a sterile, moist gauze pad for 3-5 minutes to adapt and adhere the graft to the recipient wound bed.[8]

Prominent Physical Distinguishing Characteristics

Basement membrane side	Dermal side
Dull	Shiny
Rough	Smooth
Buff - Coloured	White
Repels Blood	Absorbs Blood

APPLICATIONS

1. Gingival augmentation
2. Root coverage
3. Socket preservation
4. Ridge augmentation
5. Guided tissue regeneration
6. Guided bone regeneration

Potential Complications

1. Wound or systemic infection
2. Specific or non-specific immune response
3. Resorption of the alloderm
4. Sloughing or failure of the graft
5. Disease transmission
6. Hypersensitivity/ Allergic reactions- Though not reported in preclinical and clinical trials. Since AlloDerm is composed of proteins, proteoglycans and other components of human tissue, the potential exists for such reactions.

Clinical Studies

1. Woodyard et al 2004, reported that gingival thickness and root coverage were significantly increased when ADM is combined with coronally positioned flap compared with coronally positioned flap alone.[9]
2. Human histologic evidence comparing ADM and autogenous connective tissue grafts, documented that both formed a band of dense collagenous tissue when placed beneath a coronally advanced flap. Gingival attachment, a combination of long Junctional attachment and connective tissue adhesion, was comparable for both groups. At six months post-operatively, the overall histologic outcomes were similar for both CTG and AD grafts.[10]
3. AAP position paper on gingival recession 2005 - Support the use of ADM when combined with a coronal positioning for root coverage. They state, "the ability to cover an unlimited number of sites without the need for a second surgical site to obtain donor tissue is a significant advantage for this material".[11]
4. Multiple, randomized clinical trials (RCT) have shown root coverage results with AlloDerm to be equivalent to autogenous connective tissue, and concluded that the procedure was predictable and practical. A meta-analysis of eight RCTs showed no statistically significant differences between the two groups for measured outcomes: recession coverage, keratinized tissue formation, probing depth and clinical attachment levels.[12]
5. AlloDerm used as a barrier over resorbable hydroxyapatite in extraction sites, was able to preserve ridge dimensions and significantly increase the width of keratinized tissue.[13]

CONCLUSION

Because the components remain in their natural biologically active state, ADM is immediately recognized as human tissue. Rapid cell repopulation, revascularization and initiation of intrinsic regeneration process takes place. Complete remodeling into the patient's own tissue is possible. Acceptable functional, physiological and reconstructive outcomes. A meta analysis has noted trends of increased clinical attachment gains with and an increasing preference of ADM over other alternative for recession coverage. However there is a need for further randomized clinical studies of ADM procedures in comparison to common mucogingival surgical procedures to confirm these findings.

REFERENCES

1. Ramachandra SS, Rana R, Reetika S, Jithendra KD. Options to avoid the second surgical site: a review of literature. Cell and tissue banking, Sep 1, 2014; 15(3): 297-305.
2. Pappalardo S, Guarnieri R. Proliferation Assessment of Mesenchymal Stem Cells on an Acellular Dermal Matrix (AlloDerm® GBR) Used for Guided Bone

Regeneration. Journal of Biomaterials and Tissue Engineering, Oct 1, 2013; 3(5): 589-96.
3. Wainwright DJ. Use of an acellular allograft dermal matrix (AlloDerm) in the management of full-thickness burns. Burns, Jun 1, 1995; 21(4): 243-8.
4. Wainwright D, Madden M, Luterman A, Hunt J, Monafo W, Heimbach D, Kagan R, Sittig K, Dimick A, Herndon D. Clinical evaluation of an acellular allograft dermal matrix in full-thickness burns. The Journal of burn care & rehabilitation, Mar 1, 1996; 17(2): 124-36.
5. Livesey SA, Del Campo AA, Nag A, Nichols KB, Coleman C, inventors; LifeCell Corp, assignee. Method for processing and preserving collagen-based tissues for transplantation. United States patent US 5,336,616. 1994 Aug 9.
6. Losken A. Early results using sterilized acellular human dermis (NeoForm) in postmastectomy tissue expander breast reconstruction. Plastic and reconstructive surgery, Jun 1, 2009; 123(6): 1654-8.
7. Jundt J, Demian N. Use of Skin and Soft Tissue Substitutes in Maxillofacial Reconstruction. InRegenerative Strategies for Maxillary and Mandibular Reconstruction, 2019; 161-172. Springer, Cham.
8. Kirsner RS, Bohn G, Driver VR, Mills Sr JL, Nanney LB, Williams ML, Wu SC. Human acellular dermal wound matrix: evidence and experience. International Wound Journal, Dec, 2015; 12(6): 646-54.
9. Woodyard JG, Greenwell H, Hill M, Drisko C, Iasella JM, Scheetz J. The clinical effect of acellular dermal matrix on gingival thickness and root coverage compared to coronally positioned flap alone. Journal of periodontology, Jan, 2004; 75(1): 44-56.
10. Cummings LC, Kaldahl WB, Allen EP. Histologic evaluation of autogenous connective tissue and acellular dermal matrix grafts in humans. Journal of periodontology, Feb, 2005; 76(2): 178-86.
11. Greenwell H, Fiorellini J, Giannobile W, Offenbacher S, Salkin L, Townsend C, Sheridan P, Genco R. Oral reconstructive and corrective considerations in periodontal therapy. Journal of periodontology, Sep 1, 2005; 76(9): 1588-600.
12. McGuire MK, Scheyer ET, Nunn M. Evaluation of human recession defects treated with coronally advanced flaps and either enamel matrix derivative or connective tissue: comparison of clinical parameters at 10 years. Journal of periodontology, Nov, 2012; 83(11): 1353-62.
13. Luczyszyn SM, Papalexiou V, Novaes Jr AB, Grisi MF, Souza SL, Taba Jr M. Acellular dermal matrix and hydroxyapatite in prevention of ridge deformities after tooth extraction. Implant dentistry, Jun 1, 2005; 14(2): 176-84.