Clinical Evaluation of the Efficacy of Subepithelial Connective Tissue Graft and Acellular Dermal Matrix Graft (Alloderm) in the Treatment of Gingival Recession

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CERTIFICATE

This is to certify that this dissertation **"CLINICAL EVALUATION OF THE EFFICACY OF SUBEPITHELIAL CONNECTIVE TISSUE GRAFT AND ACELLULAR DERMAL MATRIX GRAFT (ALLODERM) IN THE TREATMENT OF GINGIVAL RECESSION"** is a bonafide record of work done by **Dr. MOHAMED KHALED**, under my guidance during his Postgraduate study period between 2002 – 2005.

This dissertation in submitted to The Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment for the degree of **Master of Dental Surgery in Branch - II Periodontics**. It has not been submitted (partial or full) for the award of any other degree of diploma

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INTRODUCTION

Gingival recession is defined as exposure of root surfaces due to the apical migration of the gingival tissue margins. To obtain root coverage in areas with localized or generalized soft tissue recessions associated with esthetic problems, root sensitivity, and/or shallow root carious lesions is one of the major therapeutic goals in mucogingival surgery. The amount of recession is clinically assessed by measuring the distance in mm from the cemento-enamel junction (CEJ) and the soft tissue margin.

This assessment is the primary outcome variable for the therapeutic endpoint of success. An additional variable is reduction in root sensitivity. Whatever the technique used, it should be predictable in producing a result with the following characteristics:

1) Root coverage to the cemento-enamel junction (CEJ) or the height of the papilla mesial and distal to the defect;
2) Tissue tightly attached to the tooth with probing sulcus depth of less than or equal to 2 mm;
3) No bleeding on probing;
4) An "adequate" band of keratinized tissue;
5) An acceptable color match to the surrounding tissue;
6) An esthetic tissue contour;
7) Minimal pain to the patient during the procedure and during the postoperative period;
8) No increase in sensitivity, preferably a decrease in sensitivity

Keeping these objectives in mind, the search for the perfect root coverage technique has taken many differing approaches. Originally, **Sullivan & Atkins (1968)** [95] described a technique for attempting root coverage using the free gingival graft. But the graft's survival over large expanses of avascular root surfaces was unpredictable. It included two surgical procedures for the patient, creating a large denuded area on the palate that becomes painful during healing. Secondly, it had to be used with caution in esthetically sensitive areas because of the inconsistent color blending of the graft with adjacent gingival tissues.

Karring & co-workers (1972) [57] demonstrated that the underlying connective tissues had a direct bearing on the type of epithelium that is superimposed upon it. Earlier Edel (1974) [26] showed that a significant increase in attached gingiva can be achieved by grafting gingival connective tissue alone.

Langer & Calagna (1982)[60] described the "SUB EPITHELIAL CONNECTIVE TISSUE GRAFT" technique to augment the edentulous ridge. Later **Langer & Langer (1985)** [61] described the same technique in detail for covering the gingival recessions on both single and multiple adjacent teeth. By incorporating the advantages of the pedicle graft such as the double blood supply from the overlying flap and the periosteal connective tissue bed, coupled with the genetic potential of the connective tissue from the palate, it was possible to maximize the graft survival. It also provided excellent esthetics. Furthermore, the palatal post-operative discomfort has been minimized by more conservative methods described recently by **Bruno (1994)** [15] and **Hurzeler & Weng (1999)** [53] to procure the connective tissue graft from the palate.

Although autografts have proven predictable when proper technique is used, they are not without their drawbacks. The donor tissue

is usually harvested from the hard palate, which necessitates an additional surgical procedure on the patient. Though, the incidence of complications such as rupturing a palatal blood vessel, post-operative infection or pain, relating to connective tissue graft is low, few complications are still possible because of the anatomical and individual variations. Also the height, length and thickness of donor tissue that can be obtained, varies with the differing anatomic dimension of the palatal vault. If the recipient site extends over a large area, it may be difficult to obtain a sufficient amount of suitable grafting material and many small grafts must be taken and pieced together.

The drawbacks inherent with autografts have instigated a search for alternate approaches. Earlier **Yukna et al (1977)** [112] had demonstrated that allogenic freeze-dried skin graft is a clinically acceptable and beneficial grafting material for the treatment of mucogingival procedures.

Recently, an acellular dermal matrix graft, (ALLODERM)® (Life Cell Inc, Tx) has been developed with significant advantages over the previous freeze dried skin allografts. It is free of all the cell components which are the targets of the rejection response and are also the potential mode of disease transmission. In addition, the integrity of the extra-acellular matrix is maintained, which is otherwise responsible for inflammatory response associated with the earlier available freeze-dried skin allografts. These unique characteristics make the acellular dermal matrix allograft completely biocompatible and safe.

With this goal in mind and the limitations of other surgical procedures, this study was undertaken to evaluate the clinical efficacy of Acellular dermal matrix graft (Alloderm) and Subepithelial Connective tissue graft in the treatment of gingival recession.

REVIEW OF LITERATURE

It is said that a smile lights up your face value and enhances the beauty of the face. The gingival components have an important bearing on the esthetics in an individual.

The American Academy of Periodontology [2] defines gingival recession as the apical displacement with exposure of the root surface of gingival marginal tissues. It implies the loss of periodontal connective tissue fibers along with root cementum and alveolar bone. Since the soft tissue margin may not always be composed of gingiva but also of alveolar mucosa, **Maynard & Wilson (1979)** [65] suggested the term "MARG1NAL TISSUE RECESSION".

Many people exhibit wide spread recession without awareness of the condition and without any symptoms. However in many patients, caries or simply sensitivity of the exposed roots or aesthetic disadvantage can be the presenting complaints. In addition, the root surface that is exposed can be subjected to abrasion, erosion and caries. Interproximal recession creates oral hygiene problems, resulting in plaque formation. Although Gingival recession seldom results in tooth loss, its sequelae can be difficult to treat.

Gingival recession at a given site is very unlikely to be induced by a single factor but may be the end point or outcome of several different factors.

Gingival recession can be classified as

Sullivan & Atkins (1968)[96] used the descriptive terms "narrow", "wide " "shallow" and "deep " to classify recession into 4 groups.

Mlinek et al (1973)[68a] quantified "Shallow-Narrow" clefts as being <3 mm in both dimensions and "deep-wide" defects as being >3 mm in both dimensions.

Miller (1985)[67] proposed 4 classes of marginal tissue recession, He classified gingival recession according to the height of the Inter proximal papillae adjacent to the defect area.

Class I : Marginal tissue recession that does not extend to the mucogingival junction, with no periodontal loss (bone or soft tissue) in the interdental area. One hundred percent root coverage can be anticipated.

Class II : Marginal tissue recession that extends to or beyond the mucogingival junction, with no periodontal loss (bone or soft tissue) in the interdental area. One hundred percent root coverage can be anticipated.

Class III : Marginal tissue recession that extends to or beyond the mucogingival junction. Loss of interdental soft and hard tissue apical to the cemento enamel junction but coronal to the level of recession, Partial root coverage can be anticipated.

Class IV: Marginal tissue recession that extends to or beyond the mucogingival junction. Loss of interdental soft and hard tissue, apical to the area of recession .

The ultimate goal in the treatment of gingival recession is the complete coverage of the denuded root, resulting in an esthetic and natural appearance of the newly gained tissue. To accomplish this objective, many surgical techniques have been described. Root coverage procedures are those surgical techniques designed to reduce the amount of root exposure.

Different Root Coverage can be categorized as follows[109]

1. Pedicle Grafts

A. Rotational flaps

- Laterally positioned flap
- Obliquely rotated flap
- Double papillae flap

B. Advanced flaps

- Coronally positioned flap
- Semilunar flap

2. FREE SOFT TISSUE GRAFT

A. Epithelialized (Classical Gingival Graft)

B. Non-epithelialized soft tissue graft.

3. COMBINATION GRAFTS

A. I-Stage procedure

- Connective tissue graft plus pedicle graft
- Biodegradable membrane barrier plus pedicle graft

B. 2-Stage procedure

- Coronally positioned previously placed soft tissue graft
- Non-biodegradable membrane barrier plus pedicle graft.

One of the first surgical procedures for covering a localized recession defects, the laterally sliding flap procedure, was described in the literature in 1950s, introduced first by **Grupe and Warren[1958]**[33]. A full-thickness flap was mobilized on the adjacent tooth and the flap was then positioned laterally and sutured to cover the exposed root surface.

This technique was later modified not to include the marginal soft tissue on the donor tooth in order to reduce the risk for recession. To reduce the potential risk for dehiscence at the donor tooth due to denudation of the bone plate, the use of a split thickness flap was proposed.

The use of pedicle grafts to correct mucogingival defects also has been proposed using an edentulous area as a donor site. The procedure is particularly useful in cases in which the attached gingiva on facial surfaces of 2 or 3 consecutive teeth is inadequate.

One of the modification of the above procedure is the double papilla flap proposed by **Cohen and Ross[1968]**[22] Here the flap is repositioned to cover defects in which, an insufficient amount of gingiva is present or in which there is an inadequate amount of gingiva in an adjacent area for lateral sliding flap. The papillae from each side of the tooth are reflected and rotated over the midfacial aspect of the recipient tooth and sutured.

The advantages of this procedure are dual blood supply and denudation only of interdental bone. The disadvantages may include pulling of sutures and tearing of the gingival papillae.

Other modifications of these procedures are the oblique rotational flap[1965][75], the rotation flap[1977][74]and the transpositioned flap[1990][8]

ADVANCED FLAPS

As an alternative to lateral transposition of soft tissue pedicle grafts, a coronally positioned flap to cover exposed root surfaces may be used. **Bernumoulin et al[1974]**[20] first reported the use of a coronally positioned flap either as a one-stage or two-stage procedure along with a free gingival graft. The requirements of this flap procedure is the presence of shallow crevicular depths on the proximal surfaces and approximately normal interproximal bone heights, tissue height within 1 mm of cementoenamel junction on adjacent teeth, reduction of any root prominence within the plane of the adjacent alveolar bone.

In situations with only shallow recession defects, the semilunar coronally repositioned flap offers an alternative approach. It was

originally presented in 1907 and reappeared in the literature in the 1980s. Described by **Tarnow**[101], this procedure involves, an incision being placed along the curvature of the free margin of the gingiva and extends into the papillae, staying atleast 2mm from the tip of the papilla on either side. The incision is made far enough apically to ensure that the apical portion of the flap rest on the bone after repositioning.

The advantages of procedure includes - less tension on the flap, no shortening of the vestibule, no reflection of the papillae and hence no esthetic compromise and no suturing.

Free soft tissue grafts. The free soft tissue graft procedure can be performed as

1) an epithelialized soft tissue graft or
2) a subepithelial connective tissue graft, both usually taken from the palate. Because the differentiation of the covering epithelium is controlled by morphogenetic stimuli from the underlying connective tissue, it is not necessary to include the epithelial lining in the free graft. **Karrin et al**[57] showed that the primary determinant of tissue specificity rests within the connective tissue. So, procedures using only connective tissue grafts have been developed.

To achieve root coverage a 2-stage procedure was advocated by which the graft was initially placed apical to the recession and allowed to heal before a second surgical procedure to coronally position the grafted tissue over the exposed root surface.[11]

In the 1980s modifications of the 1-stage grafting technique were presented, which from a root coverage point of view was more successful and predictable than the previous grafting procedure[67].Acid conditioning of the exposed root surface before the placement of the graft was

advocated as a critical treatment component for the successful outcome of the 1-stage procedure.

The classical gingival graft involves a keratinized epithelium together with variable thickness of connective tissue, obtained from the palate. The principles of classical gingival graft for root coverage was first discussed by **Sullivan & Atkins (1968)**[96]. Later, with the specific modifications suggested by **Holbrook & Ochsenbein (1983)**[51] and **Miller (1985)**[67] the free grafts from the palatal masticatory mucosa become a routinely used and highly predictable procedure in mucogingival surgery.

While the survival of the graft on wide denuded root surfaces of maxillary teeth has not been predictable, however its use has been expanded. **Maynard**[66] employed two procedures, i.e., the initial placement of a free gingival graft to create a band of keratinized gingiva followed by a second procedure in which the graft was pulled coronally. **Holbrook and Ochsenbein**[51] used thick, stretched, free gingival grafts.

Free gingival graft is a very useful procedure in cases of gingival recession associated with inadequate width of keratinized gingiva and shallow vestibule. Unfortunately, the esthetic results are not always satisfactory because of the color discrepancy between the graft and the surrounding tissues and also the keloid appearance of the grafting tissues The large denuded area created in the palate may be associated with severe post-operative complications. .

Recently, **Jahnke et al (1993)**[55] and **Paolantonio et al (1997)**[72] found connective tissue grafts to be more predictable in obtaining root coverage than the free gingival grafts.

A Guided Tissue Regeneration procedure with expanded polytetrafluoroethylene (ePTFE) membrances was proposed by **Tinti &**

Vincenzi [1990][102] to promote new attachment on denuded root surfaces. **Cortellini et al[1992]**[104] histologically determined that mucogingival surgery in conjunction with membrane resulted in the formation of a new connective tissue attachment with newly formed cementum on a human root surface which had been exposed due to long standing recession. Thus, the application of guided tissue regeneration in the treatment of gingival recessions has the advantage of root coverage and also regeneration of the lost periodontal structures. **Ricci et al [1996]**[86], **Harris [1998]**[37] in their respective studies, have shown no significant difference between guided tissue regeneration (GTR) and connective tissue graft with respect to mean root coverage. However, **Trombelli et al [1998]**[100], **Borghetti et al [1999]**[19] pointed out that the connective tissue graft produced significantly more increase in the width of keratinized gingival tissue than the guided tissue Regeneration. **Tal [1999]**[92] suggested that the Alloderm may also act as a barrier equivalent to selective cell repopulation membranes, thus encouraging periodontal regeneration.

Heijl, [1997] [50] stated that enamel matrix derivative is effective in inducing periodontal regeneration in dehiscence type defect and also demonstrated new cementum and bone gain histologically and this was supported by **Rasperine et al [2000]**[81].

Mcquire and Cochran [2003] [65] stated that Emdogain works in a biomimitic manner mimicking the natural process of tooth development as seen in their study in which a comparision of two root coverage procedures coronally advanced flap with addition of enamel matrix protein and Sub Epithelial Connective Tissue Graft.The mean % of root coverage was 87 % in Sub Epithelial Connective Tissue Graft.and 77.7% in enamel matrix derivative group. The increase in keratinized tissue

following Sub Epithelial Connective Tissue Graft has been substantiated ,Change in width of keratinized tissue was recorded with addition of the enamel matrix derivative and no change without it suggesting that enamel matrix protein does has an effect on keratinizing cell.

Connective Tissue Graft proves to be superior in root coverage and to increase the width of keratinized tissue when compared with coronally advanced flap. Enamel matrix derivative is easy procedure to perform ,presents low patient morbidity and most importantly is appropriate when complete root coverage and increased width of keratinized are not important.

CONNECTIVE TISSUE GRAFTS

Connective tissue grafts is an important treatment option of periodontal and implant reconstructive plastic surgery. The connective tissue graft was first used by **Edel (1974)**[26], **Broome & Taggart (1976)**[13], and **Donn (1978)**[24] to increase the width of keratinized gingiva.

Edel, A. (1974)[26] conducted a study to determine the predictability of using free gingival connective tissue grafts without epithelium to increase the width of keratinized gingiva. He utilized three different methods to harvest the connective tissue graft. A significant increase in attached gingiva was achieved with an average shrinkage of 28percentage of the graft, occurred at the end of 6 months. Histologically, the healed tissues showed all the normal characteristics of a fully keratinized tissue. He suggested that a connective tissue grafting can be relied upon to produce a predictable increase in the width of keratinized attached gingiva.

Broome, W. C. and Taggart, E J. (1976)[13] reported two cases of free autogenous connective tissue grafting for increasing the width of keratinized gingiva. They could observe significant increase in the width

of attached gingiva in both cases. Also, they suggested that the primary flap at the donor site must have a broad base with adequate vascular supply to prevent subsequent necrosis and post operative discomfort. They concluded that free autogenous connective tissue grafting is a clinically acceptable procedure.

Donn, B.,T. (1978)[24] conducted a 4 year long term study in humans, to evaluate wound healing both histologically and clinically following the free connective tissue autografting for increasing the width of attached gingiva. He also evaluated the role of the specificity of connective tissue in the creation of a new gingival attachment procedure. He found an adequate zone of attached gingiva being formed in rigid fixation to the recipient site. Histologically, the resultant epithelium was parakeratinized with retepeg formation. He concluded that the underlying connective tissues had a direct bearing on the type of epithelium that is superimposed upon it which enables it to achieve the same results as that of conventional free gingival autograft with less surgical damage at the donor site. He also noted a lag period of 4 to 5 days before epithelial migration onto the connective tissue substrate begins.

The use of Connective tissue grafts for gingival recession began in 1985, when **Langer & Langer**[61] described the "**SUBEPITHLIAL CONNECTIVE TISSUE GRAFT**" technique for covering gingival recessions of both single and multiple adjacent teeth. It is a bilaminar procedure and uses the combination of connective tissue and epithelium taken from the inside of a palatal flap and placed under a partial thickness flap over a denuded root.

This autogenous connective tissue graft survives due to the assistance of a double blood supply, i.e., from the connective tissue on the nondenuded portion of the root and the undersurface of the labial flap.

Connective tissue graft is placed over the recession area while nutrients and revascularization are derived from the recipient bed, inter dental papilla and the overlying flap. It was specifically designed for the wide multiple recessions frequently found in the maxilla, and combined the features of the pedicle and the free gingival graft. It employed a palatal donor site which healed with less discomfort since it was a smaller wound. They achieved 2-6 mm of root coverage in 56 cases over 4 year with minimal sulcus depth and no recurrence of recession. They also observed that this technique resulted in a closer color blend of the graft with adjacent tissue. Because of its high predictability it is considered the gold standard procedure in coverage of denuded roots.

A different version of connective tissue grafts called as "envelope technique" described by **Raetzke [1985][82].** The connective tissue graft was obtained from the palate in such a way that only a narrow surface defect was created In this technique the graft is placed directly on the denuded root surface, while its major part is inserted into an envelope that is created in the tissue around the denuded root surface with an undermining partial thickness incision. so that the connective tissue graft completely covers the formerly exposed root area. He reported 10 cases in which a total of 12 recession defects were treated. He demonstrated an average root coverage of 80percentage, of which 5 cases achieved total coverage . He could also show a significant gain of keratinized gingiva.This is indicated in cases of single tooth recession.

Nelson (1987)[69], described the "SUBPEDICLE CONNECTIVE TISSUE GRAFT' technique which combined a connective tissue graft with a full thickness double papilla graft. It was further modified by **Harris (1992)[35a],** by using a connective tissue graft with a split thickness double papilla graft. The advantage of this technique is the possibility of

covering the connective tissue graft in situations in which the coronally positioned flap may be contraindicated such as in sites with a shallow vestibular depth.

The connective tissue graft is usually retrieved from the hard palate. The location from which the graft is taken is generally palatal to the premolars. This location provides a site with few anatomical hazards, thus limiting potential complications. However, other areas such as the tuberosity region or an edentulous ridge, can also be utilized.

Becker & Becker (1986)[10] suggested that connective tissue grafting can be simultaneously performed while treating other areas of the mouth with flap surgery. Localized gingival recession is treated simultaneously with the surgical treatment of maxillary posterior region. This technique provides a conservative method of harvesting donor connective tissue and accomplishes the results of two separate surgical procedures at a single time.

And he also stated that while treating maxillary posterior segments with flap and osseous surgery. He used connective tissue graft in the same manner as the free gingival graft and observed that connective tissue graft takes slightly longer time to epithelialize when compared with epithelium containing graft. After 3 to 4 months, it was noted that graft maturation resulting into a healthy pink bank of keratinized tissue similar to that produced when traditional free gingival grafts are used.

Ouhayoun, J.P., Khattab, R., Serfaty, R. et al (1993)[70] conducted a study to determine the clinical utility of chemically separated connective tissue grafts in the treatment of gingival recession and also the histological status of chemically and surgically separated subepithelial connective tissues. They observed that chemically separated connective tissue graft healed uneventfully similar to the surgically separated

connective tissue graft. On histological evaluation, deep projection of epithelium into the connective tissue, with different morphological appearances were observed. They believed that these projections develop at the junction between the gingival flap and the transplanted connective tissue. They conclude that the chemical separation of the epithelium and connective tissue is clinically feasible for connective tissue graft. The authors suggested that the subepithelial connective tissue grafting technique should be modified to avoid the formation of epithelial projections.

Harris, R.J. (1994)[35b] described a technique for obtaining root coverage using the connective tissue graft and partial thickness double pedicle graft. He reported 20 cases in which a total 30 defects were treated. After 12 weeks, he observed a mean root coverage could be accomplished in a predictable manner.

Bruno, J.F. (1994)[15] presented some modifications of the original **Langer and langer**[61] technique for root coverage on areas of wide denudation. He suggested that mesiodistal length of the incision can be extended to provide easy access to the denuded root without the use of vertical incisions. He described two incisions without the use of vertical incisions at the palatal donor site to procure the connective tissue graft, which minimize the post-operative sequelae and promote more rapid healing.

Bouchard, P., Etienne, D., Ouhayoun, J.P. et al (1994) [14] compared the clinical and esthetic effects of two techniques of subepithelial connective tissue grafts for root coverage which differed with respect to the use of epithelial collar of the graft. After a six months follow-up, they demonstrated that both the procedures could accomplish root surface coverage in class I and class II recessions with reasonable

esthetic results. They suggested that removal of epithelial collar gives better esthetic results. However , when larger augmentation of keratinized tissue is required, connective tissue graft with the preserved epithelial collar is preferred.

Allen, A.L Allen (1994)[1], in a modification of **Raetzke's[82]** technique described the "TUNNEL OR SUPRAPERI0STEAL ENVELOPE TECHNIQUE" In which no horizontal or vertical incisions were made. In sites with two adjacent recessions, a tunnel underneath the interproximal papilla is created and the connective tissue graft is drawn through the tunnel and sutured to the recipient bed. He believed that, this technique permits conservation of existing gingiva, minimal surgical trauma to the recipient area and firm fixation of the connective tissue graft and coverage of multiple adjacent areas of recession. He suggested that the intimate co adaptation of the bilaminar soft tissue complex thus achieved, may facilitate graft survival and post-operative blending of soft tissues.

Reiser, G.M., Bruno. J.F, Mahon, P-E- et 71 (1996)[85] described the anatomy of the palatal donor site providing the subepithelial connective tissue graft He noted that variations in the size and shape of the hard palate affect the dimensions of the donor tissue harvested, as well as the location of the greater palative neurovascular bundles. They classified the palatal vaults according to height as high, average and shallow. Accordingly, the location of neurovascular bundle may vary from 7 to 17 mm from the cemento-enamel junction of the maxillary premolars and molars.

Breault, L.G., Billman, M.A., Lewis, D.M. (1997)[21] reported a case of gingival surgical cyst developing secondarily to a subepithelial connective tissue graft placed 15 months previously. A slightly raised,

firm, soft tissue mass located in the alveolar mucosa was observed adjacent to the site of the previous connective tissue graft. The histological characteristics suggested that the cyst resulted from implanted epithelial remnants of the previously placed subepithelial connective tissue graft..

Harris, R.J. (1997) [36] compared the two techniques namely the free gingival graft knife method and the parallel incisions methods, for obtaining a connective tissue graft. He observed that with free gingival graft knife method, a larger wound area was created at the donor site as a result of the high rate of sloughing of the trap door flap. But the parallel incision method produced less patient discomfort, a smaller wound at a week post-operative, a more uniform graft and was easier to use clinically. He concluded that the parallel incision method meets more of the goals of an ideal technique for harvesting a connective tissue graft than the free gingival graft knife method.

Azzi, R., Etienne, D., Sauvan, J.L.et al (1999) [4] described a surgical technique for simultaneous root coverage and papilla reconstruction. A coronally positioned flap with subepithelial connective tissue placed under the flap in the interdental area between the involved teeth. They reported a case in which they gained 4 mm soft tissue height interdentally with this technique. The authors suggested that the connective tissue graft would provide bulk and flap support and thus aid in maintaining more coronal position of the papilla during healing.

Harris, R.J., (1999) [40] examined histologically in humans, the results obtained with a connective tissue graft combined with a partial thickness double pedicle graft. He observed two different healing patterns. The first was characterized by a long junctional epithelial attachment that extended well beyond the original gingival margin and

occasionally almost to the original bone level with minimal connective tissue adjacent to the tooth. The other pattern was a short junctional epithelium that stopped at the previously exposed root surface. There was predominately connective tissue adjacent to the tooth with some isolated areas of epithelium. Also new bone or cementum was seen. He concluded that though the procedure was successful clinically, it produces no true regeneration but heals only through repair.

Hurzeler, M. B. and Weng, D. (1999) [53] described and demonstrated a new and simplified surgical approach to harvest subepithelial connective tissue grafts from the palate. In the proposed technique, only a single incision parallel to the gingival margin was used to access the donor site for graft preparation and harvesting grafts of variable sizes and thickness were obtained Since no band of epithelium was removed with the connective tissue graft, the palatal donor site could heal with primary intention. No stents or hemostatic agents were necessary to cover the donor area post-operatively and suturing was reduced to a minimum,

Blanes R.J, Allen, eE.P. in (1999) [12] described a surgical technique for the treatment of adjacent soft tissue marginal recession. The technique combined a tunnel procedure with double lateral pedicle flaps to cover a connective tissue graft. The combination was proposed to compensate for the lack of blood supply usually associated with the tunnel technique in deep or wide adjacent recession. With this technique, they observed 95percentage root coverage. The authors suggested that this technique could be used with predictable success in adjacent class I and Class II deep wide recessions and also be applied to mild class III recessions.

Several techniques have been developed to aid in the removal of a connective tissue graft for grafting purposes. They differ in the number of incisions, flap design and the techniques for gaining access to the graft.

They can be divided into techniques that provide connective tissue graft with or without a remaining band of epithelium.

Techniques that produce a connective tissue graft with an epithelial band.

Free hand technique used by **Langer & Langer (1985)**[61], in this procedure, a rectangular incision design with two horizontal and two vertical incisions were used leaving a 1.5-2 mm collar of epithelium.

Raetzke (1985)[82] harvested a palatal connective tissue graft with 2 crescent shaped horizontal incisions that converged in the depth of the palatal mucosa.

Harris (1992) [35a] used a scalpel with parallel blades 1.5mm apart for the horizontal incisions that bordered the epithelial collar. Vertical releasing incisions were reduced to the minimum, necessary for reflecting the outer flap and gaining access to the underlying donor tissue.

Bruno (1994)[15] described two horizontal incisions for harvesting connective tissue graft from the palate. The first incision on the palate was made perpendicular to the long axis of the teeth, approximately 2-3 mm apical to the gingival margin of the maxillary teeth. The second incision was made parallel to the long axis of the teeth 1 to 2 mm apical to the first incision.

Techniques that obtain a connective tissue graft without any epithelial band

Edel (1974)[26] employed a trap door approach with three incisions to harvest connective tissue graft without epithelium.

Broome & Taggart (1976)[13] used a Brasher-Rees Knife for securing the connective tissue graft after reflection of the primary partial thickness flap.

Purpose of harvesting connective tissue graft from the palate

Hurzeler & Weng (1999) [53] described a single horizontal incision to harvest the connective tissue graft from the palate. First incision was made with the blade 90º to the bone . After the first incision, the blade was angled to approximately 135º and an undermining preparation toward the median was started within the first incision.

The techniques that obtain a connective tissue graft with parts of the epithelium leave an uncovered part of the donor area that has to heal by secondary intention. This is because of the rigidity of the palatal masticatory mucosa, which does not allow for a complete closure of the donor site. Graft harvesting techniques that use a trap door approach to raise a split thickness flap generally provide good access and visibility of the underlying connective tissue. But it is associated with increased postoperative pain and risk of necrosis of the flap subsequent to any compromise in the blood supply.

The predictability of the connective tissue grafting procedures to obtain root coverage is excellent, because it provides a good blood supply to the graft.

For any given sites, **Nelson (1987)**[69] has reported a mean root coverage of 88 percentage, though **Raetzke (1985)**[82] reported the root coverage of 60 percentage - 83 percentage, **Harris (1992)**[35a] showed much higher (97 percentage) root coverage in his study. Also, it provides excellent aesthetics with good gingival color match and minimal likelihood of keloid formation. Contrary to the free gingival graft, here the donor site

wound is less extensive and hemorrhagic and perhaps less annoying to the patient. It is applicable to both isolated wide areas of gingival recession and also multiple root exposure. The main disadvantage is the fact that this technique is technically demanding and more time consuming. It also limits the number of teeth that can be covered in a single surgery. If the patient has a shallow palate or thin palatal tissues over all it becomes difficult to harvest sufficient donor tissue from one site alone. An additional site may be required and the patient has to undergo multiple surgeries just to harvest the required donor graft tissue.

In the search for a substitute donor material for masticatory mucosa ,the use of freeze dried skin has been studied. Skin allografts can be obtained from living donors or from disease free Cadavers. Cadavers are an important source because they provide large crops of allogenic skin.

The viability of human skin declines progressively after it is deprived of a vascular circulation which may be the result of the death of the individual or removal of skin from the living body. The temperature of storage determines the rate of decline in viability. The higher the temperature, the more rapid the decline in viability.

Freeze drying or Lyophilization of skin for storaqe at room temperature

Freeze drying or lyophilization [89] is a process in which water is removed from the frozen biological material by sublimation under vacuum, i.e. the liquid state is omitted, to some extent and the ice in the material is transformed directly into vapour, The final residual water will be 5-10percentage of its original water, which is low enough to inhibit enzymatic and other aqueous reactions. Once freeze dried, the tissue may be stored for long term at room temperature in evacuated containers or

water proof envelopes at 17ºC, freeze dried tissue may be sterilized by ether irradiation (eg. Gamma-radiation) or using ethylene oxide gas.

The freeze dried skin is non- viable and is structurally altered as a result of the processing procedure. Allogenic Freeze-dried skin is essentially non-immunogenic and therefore does not appear to stimulate the graft-rejection phenomenon. **Gher et al (1980)**[31] observed no evidence of hypersensitivity as determined by anti HLA antibody and lymphocyte-lysis assay.

The most common medical use of "Freeze dried skin" is in the treatment of burn patients, in which case it is supposed that the allograft acts as a biologic bandage. **Carroll et al (1974)**[23] showed that freeze dried skin allografts are biologically acceptable in the oral cavities of primates; **Yukna & Co- workers (1977)**[112] proposed freeze dried skin as a substitute for gingival autografts, and also demonstrated that allogenic freeze dried skin and autogenous fresh gingival tissues yielded essentially similar clinical results when used as donor tissues.

The important concern with the use of any allograft skin is the risk of transmitting infection especially viral and also of eliciting an immune response. Also, the damaged matrix produced by conventional freeze drying process, may be recognized as foreign body by the host and in turn may initiate an inflammatory foreign body reaction. It is known that replication of human pathogenic viruses occurs only intracellularly. Also, the cell mediated immune response is directed primarily against cells of the epidermis and endothelial & fibroblast cells in the dermis. An allogenic material, called Acellular dermal matrix graft (Alloderm) has been newly developed and marketed by the LIFE CELL INC. Acellular dermal matrix graft (Alloderm) is a dermal graft harvested from Cadavers and processed to remove the epidermal and dermal cells. The skin is

collected using a dermatome and treated so that all cellular and immunogenic elements are removed without disrupting the architecture of the dermis or crosslinking the collagen fibers. This aseptic process involves removal of the epidermis by incubation of the skin in I mol/L NaCl at 37ºC for 8 hours. Dermal fibroblasts and epithelial cells are then removed by incubation of the material in 2percentage deoxycholic acid with 10 mmol/L ethylene diaminetetracetate at room temperature, overnight. This decellularization reduces major histocompatibility complex Class I and Class II - molecules to undetectable levels. The matrix is then cryoprotected with a combination of 35percentage maltodextrin and 10 mmol/L disodium ethylene diaminetetracetate and freeze dried without damaging the extracellular matrix proteins., Thus an acellular, non-immunogenic connective tissue matrix, complete with a basement membrane complex and vascular channels is produced. Histological components of the dermal matrix include mature elastin, proteoglycans and collagen bundles with normal banding. These unique characteristics make the dermal matrix allograft completely biocompatible and there is no need for the recipient to mount a damaging inflammatory response within the graft to remove dead cells or repair damaged structures or respond to HLA incompatibilities. Also, the risk of viral disease transmission is potentially reduced.

Silverstein & Callan (1996) [91a] demonstrated that the integrity of Acellular Dermal Matrix Graft (Alloderm) is sufficient to support fibroblast infiltration and neovascularization, without inflammatory cell infiltration or cell mediated immune responses. **Wainright et al (1996)** [105] noted that the Acellular Dermal Matrix Graft (Alloderm) may undergo remodeling with time being converted to the same histological configuration as the surrounding host tissues.

Harris (1998)[39] demonstrated that both the connective tissue graft and the Acellular dermal matrix were incorporated into the surgical areas, He observed no difference in the cellular components. He used elastin fibers present in Acellular Dermal Matrix Graft (Alloderm) as a marker for the A0cellular dermal matrix graft, since elastin fibers are not normally found in the gingiva. The use of Verhoeff-Van Geison stain, specific for elastin fibers, revealed that the acellular dermal matrix was incorporated into the tissue and was not absorbed or simply exfoliated. The matrix became a part of the tissue in that area.

Acellular Dermal Matrix Graft (Alloderm) has been shown to be effective in the treatment of burns **(Wainright 1995)** [105], lip augmentation, nasal septal defect repair **(Kridel & Co-authors 1998)** [59].

Acellular Dermal Matrix Graft (Alloderm) has been used successfully to increase the zone of attached gingiva around natural teeth and dental implants **(Callan & Silverstein 1998)** [91] and to cover submerged implants immediately inserted into fresh extraction sockets **(Tal & Co-workers 1999)** [97]**.** Acellular Dermal Matrix Graft (Alloderm) was also successful as a substitute to autologous split thickness skin graft for resurfacing of Intraoral defects.

Acellular Dermal Matrix Graft (Alloderm) with its special qualities has become a suitable permanent dermal transplant. Acellular dermal matrix graft (Alloderm) may act as a substitute for free connective tissue autograft. **Harris (1998)** [37] proposed the use of an Acellular dermal matrix graft (Alloderm) and a coronally positioned pedicle graft for root coverage. **Reidy & Co-authors (1998)** [6] and **Harris (1998)** [37] have shown that the efficacy of Acellular dermal matrix graft (Alloderm) was equivalent to the connective tissue graft in obtaining root coverage. Thus, Acellular dermal matrix graft (Alloderm) may be a useful substitute for

autogenous connective tissue grafts in root coverage procedures, **Tal (1999)** [97a] suggested that Acellular dermal matrix graft (Alloderm) may also act as a barrier equivalent to selective repopulation membrane placed between the gingival connective tissue on one side and the exposed bone, periodontal ligament and root surface on the other, thus encouraging periodontal guided tissue regeneration.

Lee H Silverstein et al [1996] [91a] reported that soft tissue maintenance is the primary line of defense in protection against bacterial infection around teeth and especially endosseous implants. The use of an Acellular dermal matrix allograft material increases the width of attached keratinized gingiva around both teeth and implants. The non-immunogenic Acellular dermal allograft is readily available in unlimited supplies, is user friendly and provides a predictable color match. The esthetic results are excellent; healing is uncomplicated with less reported postoperative pain. Thus Acellular Dermal Matrix Graft (Alloderm) is a safe and predictable acellular soft tissue grafting tool that will fundamentally change soft tissue grafting around teeth and implants.

Donald P Callan [1996] [91] described a surgical technique for increasing the width of attached gingiva around implants using Acellular dermal matrix material. Soft tissue grafting was performed at the time of second surgery. After 2-3 weeks, final evaluations were made. In all cases treated, there was no loss in the width of the attached gingival tissue and all tissues appeared clinically healthy.

Shulman J [1996] [92] described the periodontal use of an Acellular dermal allograft previously available for treating burn patients. When used as a gingival graft, this new dermal allograft has major potential advantages over the previously available periodontal graft materials,

including improved color and contour match, elimination of multiple surgeries, and unlimited availability.

Lee H Silverstein [1997] [91a] described the simplistic use of a periodontal material that can be used for soft tissue augmentation procedures without using the patients own palate to procure the donor tissue. The material is an Acellular dermal matrix allograft that has been used extensively in medicine. This is a new dermal allograft with improved color and contour match, decreased patient morbidity, uniform thickness of the material, decreased doctor chair side time and less post operative pain experienced with the trauma associated with palatal autografts. This graft has been successfully used in burn surgery since 1992 and in periodontal and plastic/ reconstructive surgery since 1994. Under refrigeration the allograft can be stored for upto 2 years. The author concluded that today most of the patients undergoing reconstructive surgery have received these grafts. It is also a safe and predictable soft tissue grafting tool that is fundamentally changing soft tissue grafting.

John R Dodge et al [1998] [56] demonstrated a surgical technique that will provide complete root coverage for single or multiple teeth in a single surgical procedure. Most currently used root coverage techniques require palatal donor tissue. Recently Acellular dermal graft has become available that can substitute palatal donor tissue. The results of the six cases were presented, in which a mean of 96percentage root coverage was achieved, with 100percentage coverage on 16 of 18 teeth.

Harris RJ (1998) [37] reported a case report in which a patient was treated with a connective tissue with partial thickness double pedicle graft, which resulted in complete root coverage. However 6 days postoperative the patient developed a bleeding problem from the palatal

donor area. For this reason, a unique approach was used to treat the next area needing root coverage. The procedure combined an Acellular dermal matrix graft and a coronally positioned pedicle. He treated 3 defects, out of which 2 defects obtained complete root coverage and the third defect was covered to within 1 mm of the Cemento enamel junction. Histological studies showed similar results with a connective tissue graft and an Acellular dermal matrix graft. Verhoeff's staining demonstrated that the Acellular dermal matrix graft was incorporated into the gingival tissue. Thus, this case report demonstrated that acceptable results can be obtained with a connective tissue with partial thickness double pedicle graft and the Acellular dermal matrix combined with a coronally positioned pedicle, both clinically and histologically.

Izumi K et al [1999] [54] demonstrated the ex- vivo development of a composite oral mucosal equivalent composed of a continuous stratified layer of human oral kertinocytes grown on a cadaveric human dermal matrix in a defined medium without a feeder layer. Enzymatically dissociated human oral keratinocytes from keratinized oral mucosa were cultured, submerged in a serum-free, low-calcium (0.15 mmol/L) supplemented medium, and expanded through several passages. Once a sufficient population of keratinocytes were reached, they were seeded on 1-cm pieces of Acellular Dermal Matrix Graft (Alloderm) (life cell co, woodlands, TX), an acellular non-immunogenic cadaveric human dermis, at cell densities of 2.5 X 10[4] X 5.0 X10[4], 1.25 x 10[5], 2.5 x 10[5]. The oral keratinocyte-Acellular Dermal Matrix Graft (Alloderm) composites were cultured while submerged in a high-calcium (1.8 mmol/L) medium for 4 days. After 4 days, the composites were raised to an air-liquid interface. Samples of the composites were taken for histologic examination at 4, 11, and 18 days post seeding of the

keratinocytes on the Acellular dermal matrix graft (Alloderm). At day 4, only the seeded cell density of 2.5 X 10[5] cells/cm formed a continuous monolayer on the Acellular dermal matrix graft (Alloderm). At day 11, a continuous stratified epithelium was seen, and at day 18 a well-differentiated, confluent parakeratotic epithelial layer was developed at cell densities of 5.0 X 10[4], 1.25 X 10[5], and 2.5 X 10[5] cells/cm. They concluded that with the method used, it was possible to successfully develop an ex vivo composite oral mucosal equivalent that consisted of a strafied epidermis on a dermal matrix.

Tal H [1999] [97] examined the potential of Acellular dermal matrix allograft to be used as a substitute for autogenous connective tissue graft material in a root coverage procedure in a case with moderate gingival recession combined with reduced keratinized attached gingiva. Eight months after placement of acellular dermal matrix allograft observations and measurements showed root coverage of more than 3.5mm [>80percentage], a gingival margin that is more harmonious with the neighbouring teeth and an increase of the zone of keratinized attached gingiva from 1 – 3mm. The author concluded that Acellular dermal matrix allografts might be a possible substitute for free autogenous connective tissue grafts and/or bioabsorbable barrier membranes. He also concluded that further studies are necessary both clinical and histological, to understand the healing process of the surgical wound.

Henderson RD [1999] [56] described a surgical technique for root coverage using a new material acellular dermal allograft tissue (Alloderm). There was mean root coverage of 97 percent and out of 11 teeth treated with Acellular dermal matrix, 9 teeth gained 100 percent coverage. The results from this case series conform to the available

evidence on the use of Acellular dermal matrix in root coverage procedures.

Haeri A [1999] [34] reported that for decades, free gingival grafting has been a predictable and widely used procedure to gain keratinized tissue around teeth with mucogingival problems. Recently, a biocompatible, acellular, connective tissue material made from human dermis has been introduced as an alternative to the conventional use of autogenous tissue. This material eliminates the need for donor sites, and it minimizes postoperative discomfort and complications. It also integrates well to the recipient site, and it provides an excellent color match with the surrounding tissues, making it esthetically pleasing.

Fowler EB et al [2000] [29] presented a case report of multiple adjacent recession defects treated with Acellular dermal matrix allograft since the patient had a shallow palate from which one side would not yield an adequate quantity of connective tissue. Furthermore, the patient declined to have both sides of his palate harvested simultaneously. As an alternative, an Acellular dermal matrix allograft was utilized to correct these gingival defects negating the requirement for a second palatal surgical procedure.

Fowler EB et al [2000] [30] reported a series of case presentations, in which ridge preservation was achieved utilizing an Acellular dermal matrix graft as a barrier membrane with a demineralized freeze-dried bone allograft. This report also demonstrated an acceptable esthetic result with no loss of ridge height or width. Soft tissue dimensions were also preserved. The two graft materials were well accepted by the body and healing was rapid and without significant discomfort. The techniques illustrated in this report provide the surgeon with another option to prevent ridge collapse and ultimately improve esthetics.

Harris RJ [2000] [41] examined 2 surgical root coverage procedures. In this study, the control group was treated with a coronally positioned pedicle graft combined with a connective tissue graft and the test group was treated with an Acellular dermal matrix graft(Alloderm). There was no significant difference between reduction on probing depth [1.2mm control vs. 0.7mm test] and increase in keratinized tissue [2.0mm control vs. 1.2mm test] in both the group. The connective tissue graft produced a greater mean probing reduction and mean keratinized tissue than the Acellular dermal matrix graft. (Alloderm) However, this was not clinically significant. The results of both procedures were esthetically acceptable to the patients and clinically acceptable in all cases. In this study, the Acellular dermal matrix graft and the connective tissue graft resulted in similar amounts of root coverage.

Wei PC et al [2000] [107] reported that freeze dried Acellular dermal matrix graft (Alloderm) , originally used for full thickness burn wounds, was recently introduced as an alternative to autogenous free gingival graft , in achieving increased attached keratinized tissue. The aim of this study was to investigate the clinical efficacy of Acellular Dermal Matrix Graft allograft for achieving increased attached keratinized tissue. 12 patients participated in this study, out of which 6 patients were treated with free gingival graft and 6 with Acellular dermal matrix allograft. The results of this study suggested that the Acellular dermal matrix allograft was less effective and less predictable than the autogenous free gingival graft in terms of increasing the attached keratinized tissue. This is due to considerable shrinkage and inconsistent quality of the gained attached keratinized tissue. They also concluded that the results, in terms of esthetics using Acellular dermal matrix allograft might be better than those using the free gingival graft.

Haeri A et al [2000] [34] studied creeping attachment in autogenous and Acellular dermal matrix grafts. (Alloderm) He presented a case report of a patient with bilateral mucogingival defects in the canine and premolar areas who received an autogenous graft on one side and a dermal matrix allograft on the contralateral side. Creeping attachments were measured and compared at 3 months and 12 months after surgery. After 12 months of healing, an average of 1.23 mm of creeping ttachment was measured on the free gingival graft side and 0.96 mm of creeping attachment was measured with the dermal matrix allograft.

Harris RJ [2001] [42] used an Acellular dermal matrix to obtain an increase in the amount of keratinized tissue around four implants. In this case, the acellular dermal matrix was placed on bone. The surgical procedure resulted in an increase in the amount of keratinized tissue. Therefore, it met the clinical goals of the surgical procedure. However, the clinical findings and patient pain levels during the healing seemed to resemble a denudation procedure. Additionally, the histologic evaluation of the tissue that formed around the implants showed that the Acellular dermal matrix was not incorporated into the tissue. Based on this case, he concluded that the use of an Acellular dermal matrix placed on bone does not seem to be a good technique to increase the amount of keratinized tissue.

Batista EL Jr [2001] [9] reported that the success of bone grafting procedures depends largely on the management and integrity of the gingival flaps. Soft tissues aid in the protection of the bone graft, participate in the revascularization of the newly formed hard tissues, and play an important role in the esthetic outcome of the reconstructive phase, Acellular dermal matrix a material obtained from human skin in used in

plastic and reconstructive surgery as an allograft. It acts as a bioactive substrate for cell attachment and proliferation.

Novaes AB Jr [2001] [5] reported that the Acellular dermal matrix graft [Alloderm] is presently used to treat several soft tissue problems. It could be used for guided bone regeneration with the advantages of forming soft tissue while acting as a barrier membrane. He demonstrated in a patient who was in need of guided bone regeneration for the staged placement of an implant, and treated by using the Acellular dermal matrix graft material (Alloderm) as a barrier membrane. The authors observed that healing progressed uneventfully with the formation of adequate new bone and an increase in the width of keratinized tissue.

Harris RJ [2001][42] studied 3 surgical procedures where he compared their ability to increase the width of kertinized tissue. They are epithelialized autogenous masticatory mucosa graft [free gingival graft], autogenous connective tissue graft [connective tissue graft] and Acellular dermal matrix graft(Alloderm). 45 patients were selected and 15 patients were randomly assigned to each group. All the surgical procedures resulted in a statistically significant increase in the width of the keratinized tissue. With free gingival graft and Acellular dermal matrix graft the increase in the width of keratinized tissue was 4.1 mm and with connective tissue graft the increase was found to be 3.6 mm.

Henderson RD et al [2001] [56] determined that if the orientation of an Acellular dermal matrix allograft, basement membrane side against the tooth or connective tissue side against the tooth affected the percentage of root coverage. They also compared results of this study with the results obtained from other root coverage studies and also determined if multiple additional sites could be successfully covered with the same surgery. They determined the effect of the procedure on keratinized tissue and

evaluated the amount of creeping attachment obtained. 10 patients with class I and II defects were treated with Acellular dermal matrix graft (Alloderm) .The test sites were treated with Acellular dermal matrix graft with the basement membrane against the tooth and control sites received the connective tissue side against the root and coronally positioned flap procedure was done. They concluded that the treatment with Acellular dermal matrix graft(Alloderm) was an effective and predictable procedure for root coverage. They also found that the orientation of the material did not affect the treatment outcome for any of the parameters tested.

Aichelmann-Reidy et al [2001] [6] reported that an Acellular allogenic dermal connective tissue matrix and autogenous palatal connective tissue were compared as subepithelial grafts for the treatment of gingival recession. 22 patients were selected and exposed roots were hand root planed only and by random allocation, either fitted with Acellular allogenic dermal connective tissue matrix or connective tissue. Graft was secured in place and covered by coronally positioned flaps. The results obtained from this study showed that Acellular allogenic dermal matrix may be a useful substitute for autogenous connective tissue grafts in root coverage procedures.

Arthur B Novaes Jr et al [2001] [5] compared the clinical results of gingival recession treatment using a subepithelial connective tissue graft and an Acellular dermal matrix allograft (Alloderm). Nine patients with class I and II defects were selected and a total of 30 recession were treated and randomly assigned to the test group and the contralateral recession to the control group. In the control group, the exposed root surfaces were treated by the placement of a connective tissue graft in combination with coronally positioned flap. In the test group, an Acellular dermal matrix graft was used as a substitute for palatal donor

tissue. Pocket depth, clinical attachment level, gingival recession and width of keratinized tissue were measured 2 weeks prior to surgery and 3 and 6 months post surgery. They found that there were no statistically significant differences between the test group and the control group in terms of recession reduction, clinical attachment gain, and reduction in probing depth. Both procedures however produced an increase in keratinized tissue after 6 months. They also concluded that the Acellular dermal matrix graft may be a substitute for palatal donor tissue in root coverage procedures.

Douglas H Mahn [2002] [25] described a surgical technique that combines a modified tunnel technique and an Acellular dermal connective tissue allograft. With an aid of vertical incisions, a tunnel was created under the buccal mucosa of the affected tooth. Placement of these incisions enabled easy access for graft placement and creates mobility for gingival coronal positioning. The use of an Acellular dermal connective tissue allograft eliminated the need for a surgical palatal donor site and also minimized post surgical complications.

Tal H et al [2002] [97b] compared the efficiency of Acellular dermal matrix allograft and connective tissue graft in the treatment of gingival recession more than or equal to 4 mm. Seven patients with bilateral recession lesions participated in this study. Gingival recessions more than or equal to 4 mm were randomly treated with Acellular dermal matrix or connective tissue graft covered by coronally advanced flaps. Recession, probing depth and width of keratinized tissue were randomly treated with Acellular dermal matrix graft (Alloderm) or connective tissue graft covered by coronally advanced flaps. Recession, probing depth and width of keratinized tissue were measured preoperatively and 12 months postoperatively. Recession defects covered by Acellular dermal matrix or

connective tissue grafts, showed no practical difference. However connective tissue grafts resulted in significantly greater gain of keratinized gingiva.

Wei PC et al [2002] [107] histologically compared the microstructure of Acellular Dermal Matrix graft (Alloderm) and free gingival graft sites treated earlier. Biopsies were harvested from all 12 patients after 6 months, with the adjacent alveolar mucosa and gingiva propria and also donor palatal mucosa saved at the time of surgery. The connective tissue of Acellular Dermal Matrix Graft (Alloderm) contained dense to extremely dense collagenfibers along with scattered elastic fibers. A moderate to thin epithelial layer, with heterogeneous expression of keratinization and flat epithelium-connective tissue interface, covered the lamina propria. Both the thickness of epithelium and the degree of keratinization decreased in apical direction, being mostly para or orthokeratinized in the area close to the gingiva and non-keratinized adjacent to the alveolar mucosa. In the free gingival graft treated sites, the density of collagen fibers was less than in Acellular Dermal Matrix Graft derived tissue, palatal mucosa and the gingiva. Elastic fibers were very sparse, comparable to gingiva, but much less than in Acellular Dermal Matrix Graft derived tissue. The epithelium was moderate, somewhat thinner but the shape of the retepegs resembled that of palatal gingiva. Underneath the free gingival graft-alveolar mucosa junction, a scar band composed of extremely dense collagen fibers consistently existed. They finally concluded that the resultant tissue types of Acellular dermal matrix Graft grafts were similar to scar tissue; the non-vital dermal matrix of Acellular dermal matrix graft lacked the ability of directing cytodifferentiation of covering epithelium. Autogenous free gingival graft derived tissue are neither identical to palatal mucosa nor to the adjacent

gingiva propria; the connective tissue of the palatal mucosa only partially contributed to the differentiation of the epithelium covering the free gingival graft treated area; the epithelium/connective tissue microenvironment surrounding the recipient site influenced the epithelial differentiation of the graft. This may play a role in Acellular Dermal Matrix grafting than in grafting of autogenous free gingival graft.

Wagshall E et al [2002] [106] reported a case presentation of a 10-year-old female with class I malocclusion and a mucogingival defect on the mandibular left permanent central incisor. Gingival recession measured about 4mm with approximately 1mm of keratinized gingiva remaining and this recession was classified as Miller class I defect. Since the patient was against second surgical procedure to harvest the autograft from the palate, the Acellular dermal matrix graft (Alloderm) was placed and postoperatively there was no discomfort and follow up at one and four weeks revealed normal healing. At six months post surgery, there was complete integration of the Acellular Dermal Matrix Graft (Alloderm), there was improved gingival contour and also there was adequate zone of attached gingiva achieved.

Novaes AB Jr et al [2002] [77] demonstrated the use of an Acellular dermal matrix material as a membrane barrier to cover the implant along with a bioactive glass grafting material which was used to treat a destroyed buccal plate as a result of a longitudinal root fracture. A Frialit-2 implant was placed in the alveolus of the fractured maxillary left first bicuspid. After 6 months, they observed that the defect around the implant was completely filled by mineralized tissue.

Pontes AE et al [2002] [77] illustrated the aesthetic treatment of bilateral gingival melanin pigmentation. The most common cause of gingival pigmentation is the deposit of melanin in the basal layer of the

oral epithelium. The presence of pigmentation does not constitute a pathology, and treatments including cryosurgery, Nd; YAG laser, gingival grafts, and removal of the epithelium in the pigmented area have been described in the literature. The clinical results obtained using an Acellular dermal matrix graft (Alloderm)was compared to the postoperative results of gingivoplasty in the same patient.

Harris RJ [2002] [44] evaluated the long-term stability of the root coverage results obtained with an Acellular dermal matrix graft (Alloderm) . The mean root coverage at 12 weeks postoperative was 91.7percentage. The mean root coverage at the final postoperative evaluation (mean 18.6 months) was 87.0percentage. This difference was not statistically or clinically significant. He concluded that the root coverage results obtained with an Acellular dermal matrix(Alloderm) were predictable, esthetic, and stable over time.

Richardson CR et al [2002] [87] presented a case report involving the biopsy and subsequent histologic analysis of an Acellular dermal matrix. The area of the graft in contact with the root surface did not demonstrate a histologic attachment, but was defined as fibrous tissue apposition to the root surface. In addition, the coronal portion of the graft did not appear to be revascularized or reviatalized as would be expected with an autogenous soft tissue graft. Finally, no new cementum formation was seen, but displacement of the junctional epithelium was observed.

Paolantonio M et al [2002] [73] compared the clinical results of two bilaminar techniques by autogenous connective tissue graft or Acellular dermal matrix graft (Alloderm). A total of 30 patients were selected for the study and were divided into two groups of 15 each. At the end of the study period both the groups i.e., connective tissue group and the Acellular dermal matrix (Alloderm) group gained significant

improvements when compared with the baseline results. The authors finally concluded that the connective tissue and Acellular dermal matrix graft (Alloderm) can be used for treatment of recessions and also said that the connective tissue group attained a significantly greater increase in keratinized tissue and also showed quicker and complete healing.

Douglas H Mahn [2003] [25] described a technique in which an Acellular dermal connective tissue allograft was used to augment a buccolingual residual ridge defect. Residual ridge defects present significant limitations to the esthetic restoration of edentulous tooth sites. Augmentation techniques can aid in the reestablishment of natural ridge contours. In this case presentation, a single vertical incision was placed, which enabled the allograft to be placed laterally into a buccal pouch. Augmentation of the edentulous ridge permitted a three-unit bridge, with a highly esthetic pontic. This article presented a simplified method of esthetic ridge augmentation that reduced patient discomfort.

Buduneli E et al [2003] [17] reported a case presentation with Acellular dermal matrix allograft to increase the width of the attached gingiva in a patient suffering from epidermolysis bullosa. The patient was experiencing pain while chewing and difficulty in performing plaque control due to dramatic loss of attached gingiva after 7 years of supportive periodontal therapy. Under local anesthesia Acellular dermal matrix allograft was placed to increase the width of attached gingiva. The healing was uneventful and a significant gain in attached gingiva was observed nine months after surgery. They concluded that Acellular dermal allograft may be regarded as an alternative in the treatment of epidermolysis bullosa cases to increase the width of attached gingiva and to facilitate maintenance of their dentition.

Lewis Cummings et al [2003] [63] reported a study to document the histological results of connective tissue grafts, Acellular dermal matrix grafts (Alloderm) and coronally advanced flaps to cover denuded roots in humans. Four patients with three teeth in each patient was selected and randomly designated to receive one of the three procedures. After six months the teeth were extracted enbloc with portion of the attached facial periodontium and processed for histologic evaluation with eosin-hematoxylin and verhoeff's stain. The results showed the grafted palatal connective tissue graft appeared denser than adjacent overlying gingiva, Acellular dermal matrix graft (Alloderm) was well incorporated with new fibroblasts, vascular elements and collagen, while retaining the transplanted elastic fibers. The authors concluded that although connective tissue graft and Acellular dermal matrix graft(Alloderm) have a slightly different histological appearance both can be successfully used to cover denuded roots with clinically acceptable attachments and with no adverse healing.

Santos A et al [2003] [88] described a series of case reports, where a surgical technique was used to increase keratinized tissue and /or root coverage using an Acellular dermal matrix graft(Alloderm). After reviewing all other plastic surgical procedures, their advantages and disadvantages concluded that these procedures are technically sensitive and not so predictable. They also concluded that Acellular dermal matrix allograft (Alloderm)can be used as an alternative for root coverage without injuring the palatal donor tissue and also it overcomes the problems associated with GTR.

Anner R [2003] [3] discussed and displayed techniques and tips to improve the results of using the Acellular dermal matrix graft (Alloderm) for root coverage and also augmentation of the keratinized gingiva,

especially in extreme cases. He also reported that perforation of the cortical plate could also be done for better blood supply and also folding of the graft to augment its thickness.

Giannelli G et al [2003] [32] evaluated the efficacy of Acellular dermal matrix allograft in the surgical treatment of very wide gingival recessions. The treatment involved six patients who were treated consecutively with 46 recession defects who were treated consecutively with 46 recession defects of the marginal tissue. All the recession defects were of Miller class I and class II defects not larger than 3mm. They found that, in all cases, a reduction in recession dept and width was seen and also there was increase of the keratinized tissue. The advantage of this method being, treating adjacent multiple defects with a single surgical procedure and also reduced surgical trauma. The authors conclude that although a longer term is needed for observation, this method is easy to use, decreases operation time, gives excellent esthetic results and decreases the use of palatal autoimplantation.

Raquel Barros et al [2003] [83] compared the clinical results of two surgical procedures, the conventional and the modified procedure for the treatment of gingival recession with the Acellular dermal matrix graft . Out of the 32 bilateral Miller class I and II recessions, the control group was treated with subepithelial connective tissue graft and the test group was treated by a modified technique. In this novel procedure the releasing incisions were placed at the mesial and distal line angles of the adjacent teeth, distant from the recession, providing a broader flap for incorporation of the Acellular dermal matrix graft (Alloderm). The authors found that there were significant reduction in recession depth and width and increase in keratinized tissue and clinical attachment level for the test group after six months of study period.

Harris RJ [2003] [46] evaluated the use of an Acellular dermal matrix for soft tissue ridge augmentation. The technique he used was a modification of the procedure proposed by Langer and Calagna and involved reflecting a partial-thickness pedicle, placing an Acellular dermal matrix, and covering the Acellular dermal matrix with the pedicle. The increase in the quantity of tissue obtained was adequate to permit placing an esthetic fixed restoration in four of the five cases treated. In one of the five cases he treated, the Acellular dermal matrix became exposed and partially sloughed. This resulted in less of an increase in tissue than in the other cases. On histologic evaluation, this case showed that the entire Acellular dermal matrix did not slough but part of Acellular dermal matrix was incorporated into the tissue. He concluded that the use of an Acellular dermal matrix for soft tissue ridge augmentation is a clinically valuable technique.

Pontes AE et al [2003] [78] presented a case report in which a 12-year-old boy presented with two large gingival recessions on the maxillary central incisors, secondary to a lateral luxation. An Acellular dermal matrix graft (Alloderm) was placed as a substitute for a free gingival graft. Twelve months later, complete root coverage was achieved, and they observed that Acellular dermal matrix graft(Alloderm), a biomaterial recently developed for mucogingival surgery, could be successfully used in the treatment of gingival recession in pediatric patients.

Proussaefs P et al [2003] [79] described a technique in which an Acellular dermal allograft was used in combination with a photopolymerized acrylic resin stent to increase the zone of keratinized tissue around osseointegrated dental implants. During the second-stage surgery, a split thickness labial flap was reflected and apically

repositioned by being sutured onto the periosteum and connective tissue. The acellular dermal allograft was then sutured onto the recipient site. The acrylic resin was trimmed and secured with temporary abutments to the implants, fitting passively over the graft and then photypolymerized intraorally. The stent was left for 1 week to secure the graft in place. This technique offers an alternative mucogingival procedure for increasing the zone of keratinized tissue around osseointegrted dental implants.

Harris (2004) [47] compared short term and long term root coverage using Acellular Dermal Matrix Graft (Alloderm) and Sub epithelial connective tissue graft ,revealed an interesting finding that breakdown occurs in root coverage obtained with an acellular dermal matrix graft over a period of 48.2 months while Sub epithelial connective tissue graft reported no such finding over the same period.

SUMMARY AND CONCLUSION

The present study investigated the potential use of an Acellular dermal matrix graft (Alloderm) as an alternative for sub epithelial connective tissue graft in the treatment of gingival recession combined with coronally advanced flap. A total of sixteen sites of localized gingival recessions were treated with either sub epithelial connective tissue graft harvested from the palate or an Acellular dermal matrix graft. Both the grafts were combined with coronally advanced flap, After sixteen weeks of follow up, both the grafting procedures resulted in similar amount of root coverage. A mean root coverage of 81% was observed with sub epithelial connective tissue graft and 87% with Acellular dermal matrix graft.

From the present study, the following conclusions can be made:

i) Both, connective tissue graft and Acellular dermal matrix graft are useful and predictable surgical techniques for the treatment of gingival recessions.

ii) The root coverage obtained improves the aesthetics.

iii) There is no statistically significant difference in the mean root coverage obtained with either sub epithelial connective tissue graft (81%) or Acellular dermal matrix graft (87%). Thus Acellular dermal matrix graft can act as an effective substitute for sub epithelial connective tissue graft in the treatment of gingival recession.

iv) Acellular dermal matrix graft used in this study was well tolerated by gingival tissue and had no adverse effects on treated and adjacent non-treated sites.

This study must be interpreted with due consideration to the following limitations : relatively small sample size (patient n=8), short evaluation period. A study using large sample size and a longer follow up period is recommended for substantial data.

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