



Treatment of Root Surface Covering by Acellular Dermal Matrix

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ABSTRACT

With increase in esthetic expectations, the treatment of gingival recessions has gained importance in last few years. The aim of this treatment is to cover root surface and gain satisfactory esthetical results. Today there are many surgical methods available for this purpose. The use of sub-epithelial connective tissue graft with coronal position flap is the gold standard in the treatment of gingival recessions. However, there are some drawbacks, such as limited donor area of sub-epithelial connective tissue graft and existence of the second operational area. In order to overcome these disadvantages, acellular dermal matrixes are used in periodontal plastic surgeries as alternatives to autogenous grafts. In single tooth Miller Class I and Class II gum recessions, the best predictable results can be obtained by sub-epithelial connective tissue grafts. In addition to this, the use of acellular dermal matrix along with coronal position flap can be evaluated as an alternative for autogenous donor area.

Keywords: Gingival recession, acellular dermal matrix, alloderm

Introduction

Gingival recession has been defined as the displacement of the marginal gingiva to the apical of the enamel-cement boundary (1). In the United States, gingival recession was reported in 22.5% (about 23.8 million people) of individuals aged 30 years or older (2). However, it is thought that the prevalence, size and severity of gingival recession increase with age (3). Anatomical factors of gingiva, chronic trauma, periodontitis and sequencing of the teeth are the main conditions leading to the formation of gingival recessions (4-6). It can be seen in individuals with a good oral hygiene as well as in individuals with poor oral care (7-10). Gingival recession disrupts the aesthetics, increases the likelihood of the root surface caries and causes dentin sensitivity (2, 11-13).

Treatment of gingival recessions

Treatment of gingival recessions with periodontal plastic surgery applications has become an important treatment demanded by modern dentistry and individuals with high aesthetic expectations

(14, 15). The ultimate aim of these applications is to provide total root surface coverage and to achieve satisfactory aesthetic results (16). Many different surgical methods are used in the treatment of gingival recessions. These are free gingival graft, lateral position flap, double papillary flap, semilunar flap, coronally positioned flap (CPF), subepithelial connective tissue graft (SCTG), acellular dermal matrix allograft and directed tissue regeneration (17-22).

Among these treatment methods, the use of subepithelial connective tissue graft together with coronally positioned flap is an effective treatment that provides a high level of success in root surface coverage and is accepted as the gold standard for the treatment of gingival recessions (15, 23, 24). In addition, the thickness and width of keratinized gingival tissue is increased with this method (15). However, there are some disadvantages of the subepithelial connective tissue graft such as the presence of the second surgical site, the presence of secondary recovery in the donor site, the anatomical limitations of the donor site, limitations in the amount of grafts, increased patient morbidity,

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Received: 13.01.2017

Accepted: 28.06.2017

Cite this article as: Nazaroğlu K, Zengin Çelik T, Şirali A, Sezer U. Treatment of Root Surface Covering By Acellular Dermal Matrix. Bezmialem Science 2018; 6(3): 206-11.

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postoperative bleeding risk, and postoperative pain. In cases where it is not possible to obtain autogenous connective tissue graft, the use of acellular dermal matrix (ADM) with coronally positioned flap is presented as an alternative treatment procedure (24). Due to similar results with less morbidity, ADMs are used as an alternative to subepithelial connective tissue graft in periodontal plastic surgery (25).

The advantages of acellular dermal matrix are that they can be used in single and multiple recessions, there is no limitation in the amount of grafts, there is no second surgical site and the postoperative morbidity is lower; however, graft shrinkage, less keratinized gingival formation, and additional costs for the patient may be listed as the disadvantages (26).

Acellular Dermal Matrices

Acellular dermal matrices are allografts derived from human skin, free of epidermis and all cells. Its revascularization serves as a matrix that supports the repopulation of cells and remodeling of the tissue (27).

Intact proteins in ADMs maintain their structural framework with collagen fibrillar network, elastin filaments, hyaluronan, proteoglycan and basement membrane. Therefore, it is possible to use as a soft tissue graft.

SCTG and ADM have different healing processes due to their different cellular and vascular structures. ADM is a non-living allograft with collagen bundles and elastic fibers. While this material acts as a skeleton for the proliferation of epithelial cells, fibroblasts and blood vessels, SCTG contains some veins and cells (28). Therefore, recovery and vascularization of SCTG is based on anastomosis between the vessels of the recipient region and graft (29). Therefore, a greater amount of blood supply may be required for ADM in comparison to SCTG (15).

Acellular dermal matrices have been used in the reconstruction of skin burns in plastic surgery since the 1990s (30). The use of ADM in dentistry was first reported by Shulman (31). The use of ADM for the treatment of gingival recession was first published by Harris (32). These allografts were then started to be used in various fields of dentistry such as vertical and horizontal soft tissue augmentations, barrier membrane in directed tissue regeneration, vestibular deepening operations, elimination of melanin pigmentations, and procedures of root surface coverage in order to increase the keratinized gingival width (18, 27, 28, 33-37).

ADM has two surfaces with different properties. They have basement membrane surface which is rough and cannot easily absorb the blood and where epithelial cell migration occurs, and a smooth and blood-absorbing dermal surface which provides the development of fibroblasts and angiogenic cells (38). The presence of two surfaces with different features is important in terms of how to place it in the receiving region. While ADM is applied; it is recommended by the manufacturer that the basement membrane surface should be placed facing the root and bone, and the dermal surface facing the flap. On the other hand; in their

study designed in 2001 as split mouth in the individuals with multiple recessions, Henderson et al. placed ADM in the control region as recommended by the manufacturer, but they placed it in the test region as opposed to the company recommendation. At the end of 12-month follow-up, no significant difference was found between the groups in terms of root surface coverage and the increase in the keratinized tissue width (39).

There are 2 main types of ADM that are commercially available and are used in dentistry practice. The first of these is freeze-dried ADM (Alloderm, BioHorizons, Birmingham, AL), and the second is the ADM dehydrated with solvent (Puros Dermis, Zimmer Dental, Carlsbad, CA). The difference of these materials is based on the differences in method used when obtaining ADM from human skin.

However, the common point in both procedures is the elimination of the entire epidermis and the cellular elements of the dermis in order to obtain a material composed of collagen mesh and elastane (23). In two studies, the researchers compared these two materials in terms of the success in the amount of post-operative coverage in the procedures of root surface coverage. One of the studies was designed as split mouth (23) and the other as parallel group (40). In both studies, no statistically significant difference was found in intergroup clinical parameters and it was reported that both allografts could be used successfully in root surface coverage (23, 40).

The aim of this review is to make a comparative evaluation of the use of acellular dermal matrix (ADM) in periodontal plastic surgery procedures in which only the root surface is intended to be covered, and to indicate the current situation in the final consensus report. In our review, we used the randomized controlled studies published in the *Journal of Periodontology* which is a publication of the American Academy of Periodontology (AAP), and in the *Journal of Clinical Periodontology* which is the publication of the European Federation of Periodontology, both of which are the two great representatives of the periodontology community.

CPF / CPF + ADM Comparison

In the literature, there are both long- and short-term researches on ADM together with coronally positioned flap (CPF) application and only coronally positioned flap (CPF) application for root surface coverage (Table 1). Ahmedbeyli et al. (38) and Woodyard et al. (41) reported that the rates of root surface coverage were significantly higher in the group in which ADM was applied together with coronally positioned flap (CPF) than in the group in which only coronally positioned flap (CPF) was applied.

Ahmedbeyli et al. (38), Woodyard et al. (41), and De Queiroz Côrtes et al. (42) reported that the keratinized gingival thickness was significantly higher in the group in which ADM was applied together with coronally positioned flap (CPF) than in the group in which only coronally positioned flap (CPF) was applied. In their 2-year follow-up studies, De Queiroz Côrtes et al. (43) observed no difference in the success rates of root surface coverage by using ADM together with CPF in comparison to using only CPF in the treatment of Miller I gingival recessions; however,

they reported that using ADM together with CPF provided an increase in gingival tissue thickness and it would provide less recurrence in recession with time.

CPF+ADM / CPF+SCTG Comparison

In the literature search, we have found that there are many studies comparing the application of ADM together with coronally positioned flap for root surface coverage and the application of coronally positioned flap together with SCTG (Table 2).

Joly et al. (44) reported that both methods were effective in root surface coverage, and found a statistically significant difference

in root surface coverage and in gingival thickness increase in the group in which CPF+SCTG (subepithelial connective tissue graft) was applied in comparison to the group in which CPF+ADM was applied. In addition, they reported that the increase in keratinized gingival width did not make a significant difference between the groups.

Paolantonio et al. (45) did not find any significant difference between the two methods in terms of root surface coverage and keratinized gingival thickness, but it was reported that ADM should not be preferred in the surgical procedures aimed at increasing keratinized gingival width at a maximum level.

Table 1: Studies comparing the results of Coronally Positioned Flap together with ADM application and only Coronally Positioned Flap application in the treatment of root surface coverage

Reference	Journal / Year	Defect type	Number of individuals	Number of defects	Type of study	Groups	Average root surface coverage (%)	Follow-up duration
Ahmedbeyli	JCP / 2014	Miller I	24	48	Parallel	CPF+ADM CPF	98.84 74.99	12 months
Cortes	JCP / 2006	Miller I	13	26	Split Mouth	CPF+ADM CPF	68,4 55,9	2 months
Cortes	JOP / 2004	Miller I	13	26	Split Mouth	CPF+ADM CPF	76 71	6 months
Woodyard	JOP / 2004	Miller I / II	24	24	Paralel	KPF+ADM CPF	96 67	6 ay

JCP: Journal of Clinical Periodontology; JOP: Journal of Periodontology; CPF: Coronally Positioned Flap; ADM: Acellular Dermal Matrix

Table 2. Studies comparing the results of the use of Coronally Positioned Flap together with ADM and the use of Coronally Positioned Flap together with SCTG in the treatment of root surface coverage

Reference	Journal / Year	Defect type	Number of individuals	Number of defects	Type of study	Groups	Average root surface coverage (%)	Control time
Moslemi	JCP / 2011	Miller I / II	15	30	Split Mouth	CPF+ADM CPF+ SCTG	54,6 39,8	5 Years
Joly	JOP / 2007	Miller I /II	10	20	Split Mouth	CPF+ADM CPF+ SCTG	50 79,5	6 Months
Hirsch	JOP / 2005	Miller I /II	166	431	Parallel	CPF+ADM CPF+ SCTG	94,9 98,4	2 years
Harris	JOP / 2004	Miller I /II	50	96	Parallel	CPF+ADM CPF+ SCTG	65,8 97	3 Years
Paolantonio	JOP / 2002	Miller I /II	30	30	Parallel	CPF+ADM CPF+ SCTG	83,3 88,8	12 months
Tal	JOP / 2002	Miller I /II	7	14	Split Mouth	CPF+ADM CPF+ SCTG	89,1 88,7	12 months
Aichelmann-Reidy	JOP / 2001	Miller I /II	22	44	Split Mouth	CPF+ADM CPF+ SCTG	65,9 74,1	6 months
Novaes	JOP / 2001	Miller I /II	9	30	Split Mouth	CPF+ADM CPF+ SCTG	66,5 64,9	6 months

JCP: Journal of Clinical Periodontology; JOP: Journal of Periodontology; CPF: Coronally Positioned Flap; ADM: Acellular Dermal Matrix; SCTG: Subepithelial Connective Tissue Graft

Hirsch et al. (46) reported that although the clinical results of CPF+SCTG were more advantageous, both methods had stable, predictable and successful results lasting for 2 years.

Tal et al. (47) reported that they did not find a significant difference between the two methods in terms of root surface coverage.

Novaes et al. (48) and Aichelmann-Reidy et al. (36) reported that there was no significant difference between the two methods in terms of root surface coverage and the gain of the keratinized gingival width, though there was a numerical difference.

According to the results of a 3-year follow-up research, Harris (49) reported that the use of SCTG together with coronally positioned flap gave the best predictable and stable result.

According to the results of a 5-year follow-up study comparing the application of coronally positioned flap with ADM and coronally positioned flap with SCTG, Moslemi et al. (50) reported that;

1. There was no difference between the groups in terms of total root surface coverage and decrease in recession amount,
2. Root surface coverage obtained in the sixth month could not be maintained in both groups 5 years later,
3. While the keratinized gingival width remained stable for 6-60 months in the regions treated with SCTG, it returned to the preoperative values in the regions treated with ADM (50).

Conclusion

It is seen in studies that root surface coverage with ADM provides less keratinized gingival gain compared to SCTG. Acellular dermal matrices can be considered as an alternative to the autogenous donor site in multiple gingival recessions where the amount of keratinized gum tissue is sufficient.

In the consensus report published by the Regeneration Workshop of the American Periodontology Academy in 2015, it was reported that alloderm could be used safely instead of SCTG in both single and multiple Miller Class I and II gingival recessions (51).

Peer-review: Externally peer-reviewed.

Author Contributions

Concept - K.N., T.Z.Ç., A.Ş., U.S.; Design - K.N., T.Z.Ç., A.Ş., U.S.; Supervision - K.N., T.Z.Ç.,

A.Ş., U.S.; Resources - K.N.; Data Collection and/or Processing - T.Z.Ç.; Analysis and/or Interpretation - K.N., T.Z.Ç.; Literature Search - T.Z.Ç.; Writing Manuscript - T.Z.Ç.; Critical Review - K.N.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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