

Gingival Recession and Various Root Coverage Procedures: A Review

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ABSTRACT

Esthetics is of prime concern in today's sophisticated and modernised society. Esthetics is the science of beauty and encompasses almost every field of dentistry. Gingival recession is defined as the oral exposure of the root surface due to a displacement of the gingival margin apical to the cement-enamel junction and it is regularly linked to the deterioration of dental aesthetics. It has been associated with many factors such as inflammatory periodontal disease, developmental anatomic abnormalities (aberrant frenal attachment, thin bony plate), toothbrush injury, tooth malposition and iatrogenic factors. Apart from compromised esthetics, gingival recession also results in a variety of other problems such as root hypersensitivity, a higher incidence of root caries and diminished plaque control, thus necessitating treatment. Successful treatment of recession-type defects is based on the use of predictable periodontal plastic surgery (PPS) procedures.

Keywords: Gingival recession, cemento-enamel junction, periodontal plastic surgery

INTRODUCTION

Gingival recession is the displacement of the gingival margin apical to the cemento-enamel junction (CEJ).¹ It is observed more frequently on the labial/buccal surfaces of the teeth and is probably one of the most common esthetic concerns associated with the periodontal tissues. Recession refers to the location of the gingiva, not its condition. Receded gingiva can be inflamed but may be normal except for their position. Recession may be localized to one tooth or a group of teeth, or it may be generalized throughout the mouth.² Apart from compromised esthetics, gingival recession often results in a variety of other problems as well such as root hypersensitivity, a higher incidence of root caries and diminished plaque control, thus necessitating treatment.

ETIOLOGY OF GINGIVAL RECESSION³

The cause of gingival recession whether localized or generalized is not always easy to determine but is essential prior to treatment planning. The following factors have been incriminated.

- Inflammatory periodontal disease (considered as the principal etiologic factor), Ageing, Developmental anatomic abnormalities (dehiscences, thin bony plates, high frenum attachments), Malaligned tooth, Toothbrush trauma, Delete-

rious habits (pressure from foreign objects, fingernails, pencils, hairpins), Iatrogenic factors (orthodontic forces, pressure from bands, arch wires, clasps, subgingival restorations, post periodontal surgery).

PATHOGENESIS

The process of apical migration of marginal gingiva over the root surface results in the condition of gingival recession. The definition of the condition of gingival recession: Some slight apical shift of supra-crestal connective tissue attachment that is the cementum which is exposed and has already lost attachment to the collagenous gingival fibers which are found just coronal to the crest of the alveolar bone and just apical to the junctional epithelium. It is the continual apical migration of gingival fibers attachment and marginal gingiva which characterizes the process of recession.⁴

Histologically, the destruction of gingival tissues, due to mechanical forces or related to inflammatory periodontal disease, is associated with loss of periodontal connective tissue fibers and alveolar bone.

For gingival augmentation, the main objective is to increase width and thickness of the gingiva in areas where the amount of keratinized tissue is judged clinically inadequate. However, scientific data do not support the hypothesis that gingival tissue dimensions are critical to the prevention of gingival recession defects.^{5,6} Nevertheless, gingival augmentation should be considered where a change in mucogingival morphology may facilitate plaque control and when alveolar bone dehiscence would be anticipated as a result of orthodontic tooth movement.⁷ Ideally, surgical treatment of gingival recession defects should fully restore the anatomy of the mucogingival complex. However, aesthetic concerns are usually the reason to perform these procedures. This im-

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plies regeneration of the attachment apparatus of the tooth, including cementum with inserting connective tissue fibers, and alveolar bone, as well as recreation of topographic relationships between the keratinized tissue and the alveolar mucosa that are functionally and aesthetically acceptable to the patient.⁴

Certainly, the ultimate goal of periodontal therapy is regeneration. This involves the elimination of diseased state and replacement with a healthy state, in which all tissues that are originally found have been restored. Regeneration has been defined as "The natural renewal of a structure, produced by growth and differentiation of new cells and intercellular substance to form new tissues or part".⁸

INCIDENCE AND PREVALENCE:

Gorman⁹ stated that recession increased in both numerical as well as linear dimension with age. The occurrence of recession was found to vary from 54.5% of all the subjects in the 16-25 years of age group to 100% in the 46-86 years of age groups. The most pronounced increase was from 26-35 years to the 36-45 years of age groups. Males showed greater recession than females of the same groups.⁹ Occurrence of recession can be seen as early as 15 years as per Guilha et al.¹⁰ Woolfer¹¹ showed that incidence varies from 8% in children to 100% after the age of 50 years. Yoneyama et al.¹² stated that, it is common in populations with good as well as poor oral hygiene. Buccal recession seems to be more common and more advanced at single rooted teeth than at molars. The attachment loss difference observed between different surfaces of a given tooth or a group of teeth. The data suggested that in younger subject groups, progression was confined to a subset of individuals, while in older age groups, more subjects and sites became involved.¹⁴

A 3-year longitudinal study was conducted to find out the occurrence of gingival recession in mandibular incisors. 28 children aged 6-13 years, with gingival recession localized to mandibular incisors, were monitored longitudinally to evaluate any changes of the labial periodontal tissues. Gradual reductions in the amount of gingival recession and probing attachment levels took place in all children except for one of the subjects with one severely malpositioned tooth. Probing depths and widths of keratinized and attached gingiva remained relatively unchanged. This finding showed that, gingival recession in mandibular incisors in young children often improves over time which suggests that, preventive or reparative treatment in this part of the developing dentition may not be necessary. Decisions about such treatment should be postponed until any spontaneous improvement has taken place.¹⁵

A study was carried out to assess the development of gingival recession in young adult smokers and nonsmokers. At the outset, 50% of subjects presented with gingival recession at one or more sites. There was no significant difference in the prevalence of gingival recession between non-smokers and

smokers. The risk for recession development appeared not to be influenced by smoking status after adjusting for periodontal probing depth, recession at baseline, tooth brushing frequency, gender, jaw, tooth type and site. Their study did not support the hypothesis that, smokers are at an increased risk for the development of gingival recession.¹³

CLASSIFICATION OF GINGIVAL RECESSION

Several classification systems have been proposed in the literature in order to facilitate the diagnosis of gingival recession.

Sullivan's and Atkins in 1968 classified recession into four categories.¹⁶

Shallow – Narrow. 2) Shallow – Wide. 3) Deep – Narrow, 4) Deep – Wide

Mlinek et al in 1973 classified recession as⁴

1. Shallow-narrow clefts as being <3 mm in both dimensions.
2. Deep-wide defects as being >3 mm in both dimensions.

Miller's classification of gingival recession⁵

Four types of recession defects were categorized on the basis of evaluation of the soft and hard periodontal tissues.

Class I – Marginal tissue recession does not extend to the mucogingival junction (MGJ). There is no periodontal loss (bone or soft tissue) in the interdental area and 100% root coverage can be anticipated.

Class II - Marginal tissue recession that extends to or beyond the MGJ. There is no periodontal loss (bone or soft tissue) in the interdental area and 100% root coverage can be anticipated.

Class III - Marginal tissue recession that extends to or beyond the MGJ. Bone or soft tissue loss in the interdental area is present or there is malpositioning of the teeth, which prevents the attempting of 100% of root coverage. Partial root coverage can be anticipated.

Class IV - Marginal tissue recession that extends to or beyond the MGJ. The bone or soft tissue loss in the interdental area and/or malpositioning of teeth is so severe that root coverage cannot be anticipated.

Mahajan's modification of Miller's classification⁷

1. Class I: Gingival tissue recession not extending to mucogingival junction.
2. Class II: Gingival tissue recession extending to mucogingival junction or beyond it.
3. Class III: Gingival tissue recession with bone or soft-tissue loss in interdental area up to cervical 1/3 of root surfaces and/or malpositioning of the teeth.
4. Class IV: Gingival tissue recession with severe bone or soft tissue loss in interdental area greater than cervical 1/3 of root surface and/or severe malpositioning of teeth.

Prognosis according to Mahajan's modification

BEST - Class I and Class II with thick gingival profile.

GOOD - Class I and Class II with thin gingival profile.

FAIR - Class III with thick gingival profile.

POOR - Class III and Class IV with thin gingival profile.

Cairo et al⁷ taking into account the desirable characteristics of a classification system (usefulness, exhaustiveness, disjointness and simplicity) suggested by Murphy (1997), the following classification of gingival recession was then identified based on the assessment of clinical attachment level (CAL) at both buccal and interproximal sites.⁷

1. Recession Type 1 (RT1): Gingival recession with no loss of interproximal attachment. Interproximal cemento-enamel junction (CEJ) was clinically not detectable at both mesial and distal aspects of the tooth.
2. Recession Type 2 (RT2): Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the interproximal pocket) was less than or equal to the buccal attachment loss (measured from the buccal CEJ to the depth of the buccal pocket).
3. Recession Type 3 (RT3): Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the pocket) was higher than the buccal attachment loss (measured from the buccal CEJ to the depth of the buccal pocket).

TREATMENT OF GINGIVAL RECESSION

Compromised esthetics, root hypersensitivity, diminished plaque control, progression of defect; etc resulting from gingival recession may warrant its treatment. Investigation of etiologic factors and consideration of therapeutic options directed at minimizing the progression of apical migration of the marginal gingival tissue are the objectives for the treatment of gingival recession.

Various mucogingival surgeries have been proposed for the purpose of root coverage.¹

1. Pedicle grafts:
 - a. Rotational flaps.
 - Laterally positioned flap.
 - Obliquely rotated flap.
 - Double papilla flap.
 - b. Advanced flaps.
 - Coronally positioned flap.
 - Semilunar flap.
2. Free soft tissue grafts:
 - a. Epithelialized (classical gingival graft).
 - b. Non-epithelialized.
3. Combination grafts:
 - 1-Stage procedure.
 - Connective tissue graft plus pedicle graft.
 - Biodegradable membrane barrier plus pedicle graft.

2-Stage procedure.

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

TECHNIQUES FOR ROOT COVERAGE

Rotational flap procedures

The use of a laterally repositioned flap to cover areas with localized recession was introduced by Grupe and Warren¹⁷ which was called the laterally sliding flap operation. In order to reduce the risk for recession on the donor tooth, Grupe¹⁸ suggested that the marginal soft tissue should not be included in the flap. Staffileno¹⁹ and Pfiefer & Heller¹⁹ advocated the use of split thickness flap to minimize the potential risk for the development of dehiscence at the donor tooth.

Laterally positioned flap

Grupe & Warren¹⁷ introduced contiguous soft tissue autografts to the literature under the term "lateral sliding flap" currently known as the laterally positioned pedicle graft. For successful root coverage using laterally positioned pedicle graft, these three criteria must be met.

1. Adequate donor tissue laterally.
2. Normal to deep vestibule.
3. Recession involving only one tooth.

Double papilla repositioned flap

Double papilla graft is the variation of the laterally positioned graft which was given by Cohen and Ross.²⁰ This procedure evolved in an attempt to use minimal amounts of gingiva for root coverage. It is indicated in where there is recession of labial or lingual gingiva, but destruction of the interdental papillae on either side of the denuded area has not occurred. Recession of this type is observed in areas where trauma from incorrect tooth brushing has destroyed the gingiva and cleft formation develops. This pattern of gingival recession is noted on the labial or buccal surfaces of roots where the involved tooth is in labial version to the approximating teeth. If the adjacent area to the recession is intact with no pocket formation or minimal in the proximal areas, then joining both papillae together to form a flap will repair the area of root exposure. The restoration of the gingival unit is advantageous not only from the cosmetic standpoint but also from a functional aspect. Covering the exposed root surface with gingiva has helped to reduce or eliminate the problem of hypersensitivity. This procedure may also permit the covering of the margin of a restoration which has been exposed by recession.

Pedicle soft tissue graft procedures combined with membrane barriers:

The use of membrane barrier, according to the principles of guided tissue regeneration (GTR), in conjunction with pedi-

cle soft tissue graft procedures was introduced as a treatment modality for root coverage. A membrane barrier is placed between the graft and the root in order to favor the regeneration of the periodontium.

According to the concept of the GTR, a critical factor for the outcome of the treatment procedure is that a space for tissue formation is established between the facial root surface and the membrane and maintained during the healing. In order to create such a space, Pini Prato et al²¹ suggested that extensive root planing should be carried out to produce a concave morphology. Specially designed membranes for the treatment of recession type defects are also available, such as non-absorbable titanium-reinforced expanded polytetrafluoroethylene (ePTFE) membranes and a variety of bioabsorbable membranes but many of these may not be rigid enough for maintaining required space during healing.

FREE SOFT TISSUE GRAFT PROCEDURES

A free soft tissue of the masticatory mucosa is usually selected when,

1. There is no acceptable donor tissue present in the area adjacent to the recession defect.
2. Thicker marginal tissue is desirable.

Epithelialized soft tissue graft

The epithelialized free soft tissue graft procedure can be performed either as a two-step surgical technique, where an epithelialized free soft tissue graft is placed apical to the recession and following healing is coronally positioned over the denuded root, or as a one-step technique, in which the graft is placed directly over the root surface.

The classic epithelialized palatal graft was originally presented by King and Pennel in 1964 as a gingival augmentation procedure with the following treatment goals:

1. To establish a soft tissue margin of keratinized tissue.
2. To prevent further recession.
3. To negate the effects of an aberrant frenum.
4. To produce a soft tissue margin that enables the patient to practice a high level of plaque removal without traumatizing the soft tissue.
5. To be used as an adjunctive treatment when margins of restorations must be placed in the gingival sulcus.

Drawbacks of epithelialized palatal graft

1. The technique is difficult to perform. It is technically demanding from the suturing point of view.
2. The technique is time-consuming.
3. A blood supply to the graft is available on only one surface rather than two, as with the connective tissue graft, and so, more difficult to achieve and it is difficult to stabilize the epithelialized tissue.
4. The palatal wound (donor site) is more invasive, more prone to hemorrhage, and slower to heal. It is painful and ulcerated. Thus, it is more annoying to the patient

during the healing phase.

5. When the epithelialized palatal graft is used for root coverage grafting, a functional result is produced, but the color match of the tissues is often less than ideal. On healing, the grafted palatal tissue tends to be lighter (whiter) and more opaque than gingiva.
6. Furthermore, one does not expect to see grafted masticatory mucosa extending deep into the vestibule.
7. Another problem in free grafting is the thickness of the tissue on healing. Often a slight abrasion of the healed graft is necessary to produce the most esthetic result.

Although the subepithelial connective tissue graft has become increasingly popular for root coverage, the epithelialized palatal graft is still used for gingival augmentation when thicker tissue is desired, when esthetic is not a concern, when there is a need to deepen the vestibule, or when pinker tissue is required as in removing an amalgam "tattoo".

SUBEPITHELIAL CONNECTIVE TISSUE GRAFT (SCTG)

According to Karring et al¹⁴ gingival connective tissue is a viable source of cells for repopulating the epithelium. Free connective tissue graft was first used by Edel²² to increase the width of keratinized gingiva. The use of connective tissue graft for treatment of gingival recession was first reported in 1985 by Langer and Langer,²³ who described the "Subepithelial connective tissue graft procedure" for covering gingival recession of single as well as multiple teeth. Raetzke²⁴ performed connective tissue grafting with an "Envelope technique" and achieved 80% root coverage.

Various other modifications were proposed by Nelson²⁵, Harris²⁶, Blanes and Allen²⁷, Santerelli et al²⁸ and Tozum.^{29,30}

The SCTG is usually harvested from the palate. The thickest donor tissue can be harvested from the premolar region of the palate. If sufficient tissue cannot be obtained from one side, the contralateral side of the palate may be utilized simultaneously. Greater tissue availability is found with a high palatal vault than a low palatal vault. The height, length and thickness of donor tissue that can be obtained varies with the differing anatomic dimensions of the palatal vault.²⁹

CORONALLY ADVANCED FLAP TECHNIQUE³¹

The coronally advanced flap (CAF) is a procedure frequently used in periodontal plastic surgery. The main objective of this surgical technique is to mobilize the gingival margin and reposition it at a level more coronal (incisal direction) than its original location. CAF is mainly used for the treatment of gingival recessions. The procedure was originally introduced by Allen & Miller in 1989, throughout time. Several authors proposed modifications to the original technique.

Indications for Coronally Advanced Flap^{31,32}

1. Coverage of certain types of gingival recessions.

2. Esthetic coverage of exposed roots.
3. For tooth sensitivity owing to gingival recession.

Contraindications for Coronally Advanced Flap:

1. Lack of keratinized tissue.
2. Shallow vestibule.

Evidence shows that a coronally advanced flap alone in many instances results in complete root coverage and is stable over time. A coronally advanced flap is less invasive for the patient, requires less chair-time and probably less surgical skill. It would therefore be desirable to use a coronally advanced flap approach when indicated. It has been hypothesized that a coronally advanced flap approach alone could be successfully applied when the residual gingiva is thick and wide. It can be used in treating single or multiple recession defects. In an attempt to obtain higher success rate of root coverage in aesthetic zone, combination of different procedures have been used. A recent innovation in dentistry is the use of Platelet-Rich Fibrin (PRF), a concentrated suspension of the Concentrated Growth Factors (CGF), along with the root coverage procedures in recession defects to enhance wound healing and tissue regeneration.

CONCLUSION

Among the various treatment modalities, root coverage with coronally advanced flap holds the most promising results. Studies have been done by using this technique and the results provided significant root coverage, clinical attachment level and keratinized tissue gain as compared to various other procedures and hence could be considered as the "gold standard" procedure in the treatment of gingival recession defects.

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