Recession Coverage: Bridge from Unesthetic to Esthetic

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ABSTRACT
One of the most common esthetic concerns associated with the periodontal tissues is gingival recession. Gingival recession is the exposure of root surfaces due to apical migration of the gingival margins apical to the cementoenamel junction. Although it rarely results in tooth loss, it is associated with thermal tactile sensitivity, esthetic complaints and tendency toward root caries. As it frequently disturbs patients because of esthetics, its treatment has gained considerable importance. Many surgical techniques have been introduced including free autografts, connective tissue grafting, various flap designs, guided tissue regeneration, etc. This article describes etiology and the various surgical procedures for recession coverage.

Keywords: Connective tissue grafts, Esthetics, Free autografts, Guided tissue regeneration, Root coverage.

INTRODUCTION
Gingival recession is the displacement of marginal periodontal tissues apical to cementoenamel junction. It is a common clinical entity observed in patients, populations, regardless of their age and ethnicity. A healthy and natural appearing soft tissue architecture is critical to the establishment of an esthetic smile. As gingival recession remains a highly prevalent problem and has a potential impact on esthetics; therefore, the patients commonly ask about the treatment options for both single and multiple buccal recession defects. Health of gingiva constitutes the pink component of smile which is equally important as the white component. Therefore, the ultimate goal of root coverage procedures is the complete resolution of recession defect, with a minimum probing depth after treatment, along with a nice chromatic and texture integration of the covering tissues with the adjacent resident soft tissues.

ETIOLOGY
The etiology of gingival recession is multifactorial and several factors play role in the development of gingival recession. The common factors include: excessive or inadequate teeth brushing, destructive periodontal disease, tooth malpositioning, alveolar bone dehiscence, thin marginal tissue covering a nonvascularized root surface, high muscle attachment, frenal pull and occlusal trauma. There are four main etiologic factors that can lead to gingival recession as follows:
1. Periodontal disease
2. Mechanical forces
3. Iatrogenic factors

Periodontal Disease
In periodontal disease, the interaction between bacterial infection and immune response of the host causes matrix degradation, bone resorption, and down-growth of the epithelium, resulting in periodontal pockets, gingival recession or a combination of both. It has been suggested that a localized inflammatory process may induce epithelial proliferation into the connective tissue of the gingiva. The proliferation of the sulcular epithelial cells decreases the zone of connective tissue between the oral and sulcular epithelium. Eventually, this zone of connective tissue is obliterated by the fusion of these two epithelia. The epithelium loses its nutritional source, and gingival recession ensues.

Mechanical Forces
Faulty Toothbrushing
A common cause of recession is an aggressive use of the toothbrush which gradually abrades the gingival tissue. In these cases, while the gingiva appears free of inflammation, the apical shift of the marginal gingiva denudes root surfaces. Changing the brushing technique should be the first step in the treatment of these patients.
Iatrogenic Factors

Orthodontic Movement

Labial movement of the teeth may result in the loss of the alveolar buccal plate, followed by gingival recession.

Restorative Dentistry

Crown preparations extending subgingivally and impression techniques involving gingival retraction may be the reason for localized gingival recession. Poorly-designed partial dentures can cause gingival recession around abutment teeth.

Anatomical Factors

The anatomical factor most commonly correlated with gingival recession is a narrow band of keratinized gingiva. The areas with narrow keratinized gingiva are usually inflamed and potentially more liable to break. Other anatomical features that can be correlated to gingival recessions are the eruption patterns of teeth and their eventual tooth position in relation to the buccolingual dimension of the alveolar process. They have an effect on the position and thickness of the gingiva that will be established around the teeth.

- When a tooth is positioned facially, the bone and soft tissue on the facial of that tooth are thinner and more susceptible to soft tissue recession than the adjacent teeth.
- The lingual of the same tooth exhibits the exact opposite findings: the lingual bone and gingiva are thicker and located more coronal. There is also a high correlation between root prominence and gingival recession.

The causes of recession must be identified, and then corrected before surgical treatment is instituted to prevent further recession after surgery. Soft tissue recession is often stabilized by good nonsurgical therapy; therefore, only a small percentage of teeth with soft tissue recession will require surgical intervention because of progressive recession.

SURGICAL TECHNIQUES FOR ROOT COVERAGE

Methods for root coverage were described as early as 1956 by Grupe and Warren and Cohen and Ross in 1968. These almost always involved coronally or laterally positioned mucoperiosteal flaps which can be described as single-layer techniques.7

First described by Bjorn (1963), free gingival grafts have been widely used in the treatment of certain mucogingival problems like lack of attached gingiva and gingival recession. By using this technique, attached gingiva can be increased in a very predictable way. Furthermore, the results obtained using these procedures have been reported to be stable. Although gingival grafting is a procedure with few clinical complications, excessive hemorrhage of the donor area, failure in the graft union, delay in healing and esthetic alterations due to disparity in the color of the palatal gingiva with respect to the grafted area have been described.16

The publications by Raetzke (1985) as well as Langer and Langer (1985) were the first to describe two-layer techniques, in which the recession is not merely covered by the flap but additionally by a subepithelial connective tissue graft (CTG). This was a decisive turning point since, greater predictability was achieved with this method.

The third group is guided tissue regeneration (GTR), which has been used to cover recessions since the 1990s (Tinti and Vincenti 1990 and Pino Prato et al 1996).

Additional measures, such as chemical conditioning of the root surface or the use of biological mediators, may complement these three groups of techniques (Heinz et al 1999; Bouchard et al 2001; Sculean and Schwarz 2004).

The various methods for surgical techniques for root coverage are classified by Erpenstein and Borchard (2006) as follows:7

1. Mucoperiosteal pedicle flap-single layer technique
   - Rotational flap
   - Lateral sliding flap
   - Double papilla flap
   - Transpositional flap.
2. Coronally advanced flap
   - Trapezoidal flap with vertical incisions
   - Semilunar flap.
3. Laterally advanced split flap + connective tissue graft
4. Double papilla flap + connective tissue graft
5. Envelope technique + connective tissue graft.
3. Guided tissue regeneration
   - Nonabsorbable membranes
   - Bioabsorbable, prefabricated membranes
   - Bioabsorbable membranes produced at the chair side.
4. Additional measures
   - Conditioning of the root surface (citric acid, tetracycline-HCL, EDTA)
   - Biological mediators (e.g. enamel matrix derivatives, platelet-rich plasma).
A successful root coverage procedure requires a clearly defined intention. This means that a controlled variable (therapy) remains directionless as long as the objective (treatment outcome) is not defined. Even though the diagnosis ‘recession’ is of major importance, it does not solely determine the medical necessity for a surgical intervention. There must be additional findings to ethically justify the surgical procedure. Therapy based on clinical findings is only possible when all evidence-based methods are mastered.7

MUCOPERIOSTEAL PEDICLE FLAP-SINGLE LAYER TECHNIQUE

A pedicle graft is a mucogingival flap designed to serve as a soft tissue graft that maintains an intact blood supply from the donor site.8 Mucogingival flaps can be divided into four major groups based on the direction of the flap movement:
1. Rotated flaps
2. Advanced flaps
3. Apically positioned flap
4. Replaced flap.
   Rotated and advanced flaps are used for recession coverage.

ROTATED FLAPS

The displacement is a lateral movement of rotation. At first it was described as the “lateral sliding flap” by Grupe and Warren in 1956. The “oblique rotational flap”, the “rotation flap” and the “transpositioned flap” are modifications in incision design. When the lateral movement is both mesial and distal to the defect, the rotational flap is called a double papilla flap. Bahal et al in 1990 modified the oblique rotational flap and gave transpositional flap, which is a local flap consisting of segment of gingiva and mucosa that turns around a pivot point.8 It is further of three types:
1. Laterally positioned flap
2. Double papilla flap
3. Transpositional flap.

Laterally Positioned Flap

The technique was described by Grupe and Warren in 1956 as the “lateral sliding flap” and later as the “laterally positioned flap”. This technique uses the donor gingiva from a healthy adjacent tooth to cover the exposed root of a problem tooth. An isolated area of soft tissue recession with no bone loss on the proximal surface is a good indication for the laterally positioned flap to cover the exposed root. The ideal indication is where the donor site has excessive width and thickness of soft tissue, such as in crowded teeth, where the most lingual tooth (donor) will usually have the thickest and most coronally positioned soft tissue and bone. The adjacent tooth is positioned more facial (recipient) and has little or no gingiva with root exposure. The major disadvantage of this technique is that recession occurs routinely over the donor site.5

Many modified methods of Grupe and Warren have been developed to avoid gingival recession on the donor site. Staffileno in 1964 advocated the use of a partial thickness flap to avoid recession on the donor site.18 Grupe in 1966 reported a modified technique to preserve the marginal gingiva by making a submarginal incision on the donor site.9 However, laterally positioned full-thickness flaps have the best prognosis for exposed root surface coverage.

Pfeifer and Heller in 1971 reported that reattachment on the exposed root surface is more likely to occur with full-thickness laterally positioned flaps than with partial-thickness flaps.12 Therefore, full-thickness flaps are appropriate for root coverage, and partial-thickness laterally positioned flaps are suitable for increasing the width of the attached gingiva.

Ruben et al in 1976 demonstrated the method of the partial and full-thickness pedicle flap; a full-thickness flap is prepared to cover the exposed root and a partial thickness flap is prepared near the donor site to protect the exposed root site and to prevent bone loss by preserving periosteum.13

Double Papilla Flap

In 1968, Cohen and Ross described the double papilla repositioned flap using the interproximal papillae to cover recessions and correct gingival defects in areas of insufficient gingiva.10

Transpositional Flap

Bahat et al in 1990 modified the oblique rotational flap introduced by Pennel et al (1965). This is called the transpositional flap.17 The transpositional flap is a local flap consisting of a segment of gingiva and mucosa that turns around a pivot point. The radius of its arc is the line of greatest tension of the flap. The base is well-anchored in the lip substance. Despite the unfavorable length: width ratio, this random flap is well vascularized through perforating arterioles in its base and through its muscular deep layers. The extension into the vestibule allows the point of rotation to be transferred. This flap becomes shorter in effective length the further it rotates. However, the versatility of this flap for root coverage and other oral plastic and reconstructive efforts is greatly enhanced because of the apical extension of the pivot point.2
ADVANCED FLAPS

Advanced flaps move vertically in a coronal direction and do not deviate laterally. These flaps are used to cover exposed root surfaces, and when teeth are not present, this type of flap is used for reconstructive surgery, such as ridge augmentation. It includes as follows:

- Coronally positioned flap
- Semilunar flap

Coronally Positioned Flap

The coronally advanced flap was first introduced by Norberg in 1926 as an esthetic surgical procedure for root coverage. The ideal case for a coronally positioned flap has adequate thickness and width of the gingiva on the leading edge of the flap to be advanced. This can be native tissue or it can be the result of a previous procedure used to increase the thickness of tissue to at least 1 mm. The keratinized gingiva has to be wide enough to secure a suture and maintain a stable and secure gingival flap during the healing process.

Semilunar Flap

The procedure was originally performed by Tarnow et al in 1986. The semilunar flap differs in the incision design from the coronally positioned flap, but the direction of movement is the same. This flap needs a minimum of 2 to 3 mm of keratinized gingiva with adequate thickness to allow for manipulation.

Modification of coronally advanced flap was proposed by Ozcelik et al (2011) who advocated the use of orthodontic buttons with coronally advanced flap to maximize the stabilization of immediate postoperative location of gingival margin.

RECESSION COVERAGE WITH FREE AUTOGRRAFTS

Successful coverage of exposed roots for esthetics as well as functional reasons has been the objective of various mucogingival problems. This has been achieved through various free soft tissue grafts. Soft tissues are transferred from an area distant to the recession to cover the defect. The graft can be nonsubmerged, i.e. placed on the surface of the recipient bed; or submerged, when the graft is completely or partially covered by the flap. Nonsubmerged grafts include free gingival graft. Submerged grafts include the subepithelial connective tissue graft which combines a free connective tissue graft and pedicle soft tissue grafts.

SPLIT PEDICLE FLAPS WITH SUBEPITHELIAL CONNECTIVE TISSUE GRAFT: TWO-LAYER TECHNIQUES

Two-layer techniques are characterized by the fact that a connective tissue graft is laid between the flaps (split flaps) and the root surface. The connective tissue graft (CTG) can be harvested with or without a ridge of epithelium, although the latter method predominates. The graft that can be interposed between the two layers can be subepithelial connective tissue graft.

SUBEPITHELIAL CONNECTIVE TISSUE GRAFT (LANGER)

The subepithelial connective tissue procedure is indicated for larger and multiple defects with good vestibular depth and gingival thickness to allow a split-thickness flap to be elevated. Adjacent to the denuded root surface, the donor connective tissue is sandwiched between the split flap. This technique was described by Langer B and Langer L in 1985.

A modification of connective tissue graft, i.e. bilateral pedicle flap-tunnel technique was introduced by Blanes and Allen (1999) for the treatment of adjacent soft tissue marginal recession. This technique combines the use of a tunnel procedure with double lateral pedicle flaps to cover a CTG.

GUIDED TISSUE REGENERATION

Guided tissue regeneration using membranes is the group of techniques employed for recession coverage. In 1976, Melcher suggested that the cell type that repopulates the root surface after periodontal surgery will determine the type of attachment that forms on the root surface. If mesenchymal cells from the PDL or perivascular region of the bone proliferate and colonize the root surface, regeneration occurs. Alternatively, if lost tissue is replaced by the surrounding tissue to form a scar, repair occurs. There are two types of membranes used in guided tissue regeneration: nonresorbable and absorbable membranes (sometimes called nonresorbable and resorbable, respectively). These membranes can be classified as:

1. Nonbioresorbable membrane
   - Expanded polytetrafluoroethylene (ePTFE)
   - Miscellaneous membranes (Millipore membrane, rubber dam)

2. Bioresorbable membranes
   - Synthetic polymers
     - Polyurethane
     - Polylactic acid
- Lactide/glycolide copolymers (e.g. polyglactin-910)
- Polylactic acid blended with citric acid ester
- Natural biomaterials (e.g. collagen)
- Calcium sulfate.

**ADDITIONAL MEASURES**

It includes conditioning of the roots and biological mediators.

**Conditioning of the Roots**

One of the most critical steps in root coverage surgery is proper root preparation before placing the soft tissue graft. The key step is root planing to remove plaque and calculus, and to smooth the root. Some practitioners then use chemicals to condition the root, including citric acid, tetracycline hydrochloride, and ethylenediaminetetraacetic acid. The biologic rationale for the procedure is to detoxify and demineralize the root surface to encourage a fibrin linkage between the exposed collagen fibers on the root surface and the graft collagen fibers.8

**Biological Mediators**

These include enamel matrix derivatives (EMD) and platelet-rich plasma (PRP).

**Enamel Matrix Derivative**

Enamel matrix derivative harvested from developing porcine teeth has been reported to induce periodontal regeneration. The rationale for the mechanism of action is that EMD contains a protein preparation that mimics the matrix proteins that induce cementogenesis.

Enamel matrix derivative is an acetic acid extracted protein preparation from developing porcine tooth buds that contains a mixture of low molecular weight proteins. The major constituents are amelogenins, which are highly hydrophobic proteins that aggregate and serve as a nidus for crystallization. Other proteins identified include ameloblastin and enamelin. This protein preparation uses propylene glycol alginate (PGA) as a carrier. The EMD-containing PGA remains highly viscous when stored in the cold or at room temperature. Once it is applied to the tissue at a neutral pH and at body temperature, the PGA carrier decreases in viscosity, and the EMD preparation precipitates. Enamel matrix derivative is absorbed into the HA and collagen fibers of the root surface, where it induces cementum formation followed by periodontal regeneration.

**Platelet-Rich Plasma Preparation**

Platelet-rich plasma is essentially an increased concentration of autologous platelets suspended in a small amount of plasma after centrifugation. Because the platelets are autologous, they are able to secrete bioactive growth factors upon activation and subsequent degranulation of their alpha granules. These growth factors are also present at increased concentrations in PRP and are involved in key stages of wound healing and regenerative processes including chemotaxis, proliferation, differentiation and angiogenesis. In addition to growth factors, platelets release numerous other substances that are important in wound healing.3

**CONCLUSION**

Gingival recession is a common and undesirable condition. As gingival recession is considered to be multifactorial, knowing the cause of recession would greatly help in planning of an appropriate clinical approach directed to improve the prognosis of this type of periodontal lesion. Due to an increasing public demand for cosmetic dentistry, the treatment of gingival recession has become an important therapeutic and esthetic issue for the contemporary periodontal practice. Ultimate goal of root coverage procedures should be complete coverage of the recession defect with a pleasing color and tissue blend between the treated area and adjacent tissues, thereby achieving both biologic and esthetic success.

**REFERENCES**


