

Coronally Positioned Flap for Root Coverage At Single And Multiple Teeth-An Evidence-Based Review Article

¹Dr. Deeksha Ahuja Jhatta, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali (Punjab) India

²Dr. Gurpreet Kaur, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali (Punjab) India

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Corresponding Author: Dr. Deeksha Ahuja Jhatta, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali (Punjab) India

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Abstract

Gingival recession is defined as the apical migration of the gingival margin beyond the cement enamel junction (CEJ). This results in the exposure of tooth roots which is aesthetically displeasing and can also result in tooth hypersensitivity. In the past two decades, clinicians and researchers have demonstrated an increasing interest in mucogingival surgery to reconstruct soft tissue around teeth and implants. Surgical procedures of the mucogingival complex aim at correcting defects in the morphology, position, or enhance the dental gingival junction, since defects in the morphology of the gingival and alveolar mucosa can accelerate the course of periodontal disease, or interfere with the successful outcome of periodontal treatment. This review aims at explaining different techniques of coronally positioned

flap for recession coverage of single teeth and multiple teeth.

Keywords

Coronally positioned flap, Root Coverage Procedure, Recession, Hypersensitivity

Introduction

Root coverage in the treatment of marginal tissue recession is one of the most demanding clinical challenges; therefore, being familiar with surgical techniques helps make the right decision for successful treatment. Gingival recession is the result of gingival margin migration from the cemento-enamel junction towards apical, leaving the root surface exposed and leading to esthetic problems, dentin sensitivity, and areas of difficult access for oral hygiene. This makes it one of the most common reasons for periodontal consultation.

Periodontal plastic surgery aims to correct or eliminate anatomical, developmental, or traumatic alterations of the gingiva, which may produce apical displacement of gingival margin and result in root exposure. (7)

Periodontal surgery seeking root coverage takes into account several factors that must be considered when analyzing each case: anatomy and position of teeth, bone density, amount of interproximal bone, type of marginal recession, gingival characteristics, shape of gingival margin, width and depth of recession, and width of keratinized gingiva (whether it is present or absent). Prognosis and predictability of the technique to be used depend on these factors. It is important to be aware of the goal of periodontal surgery in order to determine the procedure that will be used, having the expectations of both clinician and patient in mind. The actual location of gingiva, not its apparent location, is the one that determines severity of the recession. (1) Recessions may be found in either a single tooth or a group of teeth, or even generalized in the entire mouth. The cemento-enamel junction serves as a point of reference for definition, diagnosis and treatment of gingival recessions. (2)

The ultimate goal of root-coverage procedures is the complete resolution of the recession defect, with minimal probing depths after treatment, along with a nice chromatic and texture integration of the covering tissues with the adjacent resident soft tissues. Clinicians are challenged to achieve outcomes that meet these exacting standards, and therefore need a sound, clinically oriented and scientifically supported decision-making process to plan the therapeutic approach, to predict the outcome and, finally, to achieve it. Various root coverage procedures have been successfully performed to correct this common periodontal problem. However, achieving a

predictable outcome of such procedures is still a challenge for periodontists. Pedicled flaps are probably the simplest procedures for managing gingival recession. (3) Optimum root coverage, good color blending of the treated area with adjacent tissues, and complete recovery of original soft tissue morphology can be accomplished by this procedure. Although being less predictable in terms of successful outcome, the postoperative healing in pedicled flaps is less troublesome for the patient as compared to free gingival or connective tissue grafts.

The term 'Periodontal Plastic Surgery', initially suggested by Miller in 1993, became accepted in modern periodontology to denote 'surgical procedures performed to prevent or correct anatomic, developmental, traumatic or disease-induced defects of the gingiva, alveolar mucosa or bone. (11) There are various surgical procedures for root coverage mentioned in the dental literature, with each procedure having its own advantage, limitation, indication and feasibility. These include: free gingival graft, coronally advanced flap, subepithelial connective tissue graft, pedicle flap, semilunar flap, transpositional flap, connective tissue pedicle graft, guided tissue regeneration etc. (4), (5)

Among the pedicle grafts, the coronally advanced flap is the commonly been used as a means of gaining root coverage and has varying degree of success. This procedure involves coronal positioning of gingival tissue covering the defect providing excellent esthetic result. (9) It is one of the valid surgical options to cover exposed root surfaces. Advantages of this technique over other surgical procedures for treating gingival recession are: it does not require a separate surgical site to obtain a graft, it has perfect color/contour match with the surrounding tissue, the procedure is not technique sensitive, thus making it simple to perform. It does not require an

extended surgical or recovery time. The results are stable overtime. Limitations of this technique include the need for adequate width of attached gingiva and adequate depth of vestibule. Most of the studies support the hypothesis that therapy with coronally advanced flap alone can be successfully applied when the residual gingiva is thick and wide. Accordingly, the adjunctive use of a graft could be restricted to sites with thin and narrow residual gingiva. (10)

The purpose of this manuscript is to evaluate one of the procedures used in periodontal plastic surgery for root coverage at single and multiple recession defects and to assess the clinical and esthetic outcomes of that various types of plastic surgery.

Gingival Recession – A Brief Review

Etiology and Classification

Gingival recession has been described as the oral exposure of the root surface as a result of displacement of the gingival margin apical to the cemento-enamel junction, with or without interdental soft and hard tissue loss.

Data from epidemiologic studies conducted in different regions of the world, comprising both adult and young subjects, with or without adequate dental biofilm control, show that buccal gingival recession is highly prevalent. (12)

Etiologically, the development of recession-type defects can be related to the following anatomic-, pathologic-, professional (iatrogenic)-, or traumatic-related factors:

- Anatomic-related factor: lack of attached gingiva, muscular inserts near the gingival margin, poor tooth alignment, or inadequate thickness of the alveolar bone plate and root prominences.

- Pathologic-related factors: periodontitis or viral infection.
- Iatrogenic-related factors: improper restorations invading the biological space.
- Traumatic-related factors: trauma associated with toothbrushing or other objects in close contact to the gingival margin (e.g. lip piercing).

With respect to the anatomic characteristics of these defects, different classification systems have been reported in which the amount of tissue lost over the exposed root surface is described. Of these systems, the Classification of Marginal Tissue Recession is the one most commonly used and accepted by the scientific community: it was proposed by Miller in 1985 (Figure 1 & 2), who used it to separate recession-type defects into four classic morphological groups: (6)

Class I: Marginal tissue recession not extending to the mucogingival junction (MGJ). No loss of interdental bone or soft-tissue. 100% root coverage.

Class II: Marginal recession extending to or beyond the MGJ. No loss of interdental bone or soft-tissue. 100% root coverage.

Class III: Marginal tissue recession extends to or beyond the MGJ. Loss of interdental bone or soft-tissue is apical to the CEJ, but coronal to the apical extent of the marginal tissue recession. Partial root coverage.

Class IV: Marginal tissue recession extends to or beyond the MGJ. Loss of interdental bone extends to a level apical to the extent of the marginal tissue recession. No root coverage.

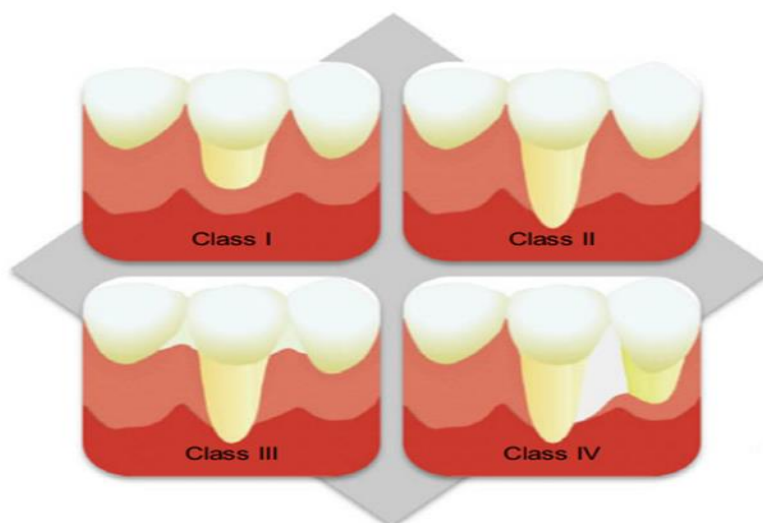


Figure 1:
Miller's classification of gingival recessions



Figure 1:
Miller's classification of gingival recessions- clinical view

Based on his clinical experience, Miller suggested, that complete coverage of recession defects was feasible only for classes I and II, partial coverage was achievable for class III and no root coverage was possible for class IV.

Root Coverage Procedures: Evolution from Mucogingival Surgery to Periodontal Plastic Surgery

As previously reported, recession-type defects are linked to esthetic, functional, and health conditions. In their historical note published in the early 1980s, Baer and Benjamin (13) narrated that the first reports describing the use of pedicle or free soft tissue grafts for the treatment of recession-type defects originated at the

beginning of the 20th century. However, “scientific interest” in these procedures, apparently remained “forgotten” until the mid-1950s when techniques exploring laterally positioned and coronally positioned flaps were proposed specifically to cover denuded root surfaces. Since then, modifications to pedicle flaps, as well as the use of free gingival grafts, subepithelial connective tissue grafts, guided tissue regeneration, and other procedures associated with several biomaterials have been proposed and evaluated, formerly as part of mucogingival therapy/ surgery and currently as periodontal plastic surgery procedures (Figure 3). As originally defined by Miller, periodontal plastic surgery comprises different surgical techniques that aim to

correct and prevent anatomic, developmental, traumatic, or plaque disease-induced defects of the gingiva, alveolar mucosa, or bone, (14) and it represents an important aspect in modern periodontology. On the other hand, despite the vast number of procedures appraising the efficacy or effectiveness of root coverage in recent decades, substantial disparity in outcomes can be found between and within procedures as a result of methodological differences between studies. Consequently, accurate and reliable tools for assessing data obtained from clinical research have also been introduced and used in the contemporary clinical decision-making process.

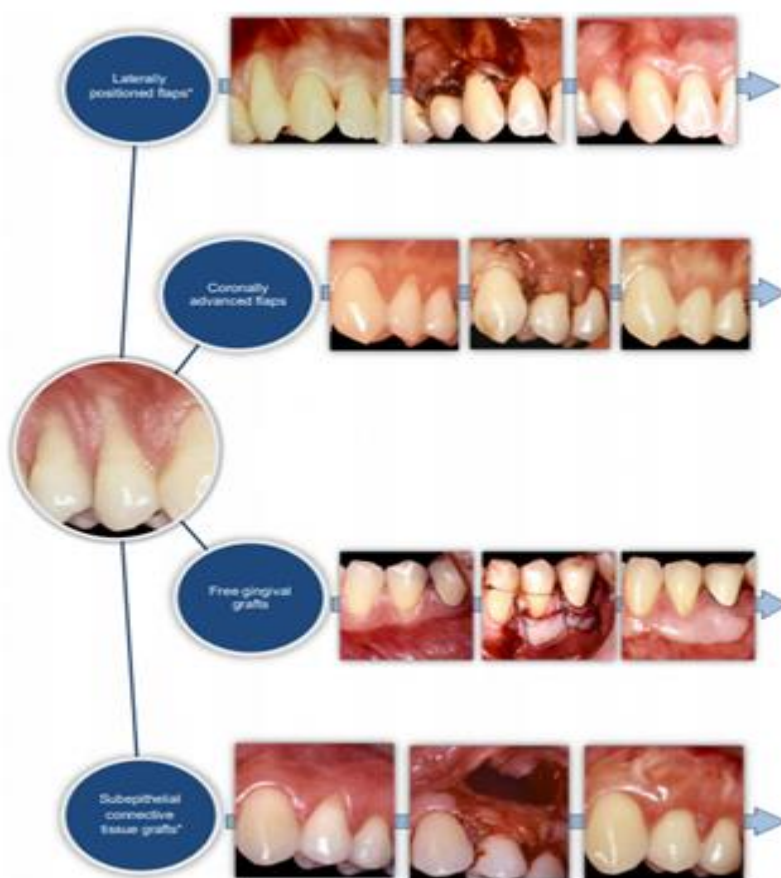




Figure 3:
Examples of periodontal plastic surgery procedures proposed for root coverage

Indications and Principles of Periodontal Plastic Surgery for Root Coverage


The major indications for root-coverage procedures are esthetic requests, treatment of dental sensitivity and increase of keratinized tissue to reduce the risk of defect progression. The clinical goal of the root coverage procedure is complete root coverage, meaning a location of the gingival margin slightly coronal to the cemento–enamel junction with no residual probing depth and with no detectable inflammation. (15) However, the gingival margin position by itself may not ensure a successful esthetic outcome, as poor esthetics can occur in the presence of an irregular profile of the gingival margin, poor color matching or scar tissue. Importantly, treatment of gingival recession should focus on the total esthetic outcome, not just on complete root coverage (14). Surgical measures to obtain root coverage involve placement of surgical flaps onto exposed roots, often in conjunction with grafts, followed by a series of complex healing events. The surgical flap must have sufficient thickness to accommodate nutritional requirements in order to stabilize over the avascular root.


In a pioneering study in a dog model, Wildeman & Wentz (15) divided the healing process after pedicle graft surgery into four stages:

 **Adaptation stage (0–4 days).** The surgical flap is separated from the root by a thin fibrin layer, and proliferating epithelial cells start to make contact with the root surface.

 **Proliferation stage (4–21 days).** Connective tissue invades the fibrin layer from the basal level of the flap, and fibroblasts are detectable near the root surface and differentiate into cement oblasts. Epithelium is detected over the root at the coronal level of the wound, while a thin connective tissue is

detectable more apically, even if fibers are not inserted into the root at this stage.

 **Attachment stage (21–28 days).** Fibers are inserted into a layer of new cementum in the apical part of the recession defect.

 **Maturation stage (1–6 months).** An increase in formation of collagen fibers occurs in this period, leading to a variable amount of connective tissue repair coronal to the bone crest and apical to the junctional epithelium. A similar arrangement of fibroblasts and collagen fibers is evident at the level of the crestal alveolar bone.

A later study by Kon et al. (16) showed that the highest degree of cellular activity occurred 6 days following surgery and was associated with the formation of new connective tissue within the blood clot. Mormann & Ciancio (17), who used € fluorescein angiography to study gingival vessel formation during healing and variations in gingival blood supply at various flap designs, concluded that the flap base should be wide to incorporate as many suprapariosteal vessels as possible, that a certain positive relationship was mandatory between the flap length and the flap base, and that flap tension should be avoided to prevent vessel constriction at the time of suturing.

Prognostic Factors for Root Coverage

Patient-related factors

Smoking is associated with impaired periodontal healing as a result of vasoconstriction, microvascular occlusion, tissue ischemia and higher risk of postsurgical infection, and is a potential negative predictor of root coverage outcome.

Tooth-related factors

Loss of interdental bone has traditionally been considered as a great limitation in the treatment of gingival

recession. Based mainly on free gingival graft procedures, root coverage was thought to be fully achievable for Miller class I and II defects, only partially achievable for Miller class III defects and not possible for Miller class IV defects.

Treatment-related factors: Pini-Prato et al. (18) studied the effect of root surface treatment on single recessions treated by coronally advanced flap, and found at 3 months posttreatment no significant difference between heavy root planing and gentle treatment with a rubber cup and prophylaxis paste. Saletta et al. (19) detected no alteration in root curvature following vigorous root planing. Also, various studies have shown no significant benefits in adding chemical agents, such as citric acid or

tetracycline-HCl, to exposed root surfaces during treatment of gingival recessions. The body of evidence suggests that heavy mechanical treatment of exposed roots and intentional removal of cementum / root dentin are not warranted as a pretreatment for root coverage. Flap tension may be a critical factor during healing, as excessive tension may interfere with the blood supply from suprapariosteal vessels, causing constriction and hindering proper blood support of the gingival graft over the exposed root surface. Also, the position of the gingival margin in relation to the cemento–enamel junction is an important prognosticative factor for root coverage (Figure 4)



FIGURE 4:
Factors associated with success of root coverage procedures

Single Gingival Recession Treatment

Several surgical techniques have been proposed to treat single gingival recessions, mostly based on repositioning keratinized tissue adjacent to the recession site onto the

exposed root. In fact, the ‘laterally sliding flap’, introduced by Grupe& Warren in 1956, was, for decades, considered as the gold standard in the treatment of gingival recession. In the modern era, Coronally

Advanced Plastic surgery for gingival recession, or its possible combinations with soft-tissue grafts or biomaterials, has become a common procedure to obtain root coverage at single recession sites.

Coronally advanced flap and its combinations for single recession

The coronally advanced flap procedure involves a coronal shift of the soft tissue located apically to the recession to cover the exposed root. In 1926, Norberg (3) outlined aspects of the procedure, but Bernimoulin et al. (9), in 1975, were the first to describe the coronally advanced flap technique at both single and multiple recessions, which was performed subsequently to free gingival graft augmentation.

In 1989, Allen & Miller (20) proposed a coronally advanced flap technique for single recession that needed no previous gingival augmentation if at least 3 mm of residual keratinized tissue was present. The technique included a split-thickness flap with two vertical releasing incisions that was raised beyond the mucogingival junction to detach the alveolar mucosa to allow for a coronal shift of the residual keratinized tissue.

De Sanctis&Zucchelli (21) proposed a modified coronally advanced flap procedure for single recession sites, performed as follows: two horizontally bevelled incisions, mesial and distal to the recession defect, located at the papilla bases, with a distance from the tip of the anatomical papillae equal to the depth of the recession plus 1 mm, allowed suturing of the gingival margin coronally to the cemento–enamel junction. two bevelled oblique, slightly divergent, incisions starting at the end of the two horizontal incisions and extending to the alveolar mucosa for 3–4 mm were then made. The resulting flap was a combined split-thickness (surgical papilla), full-thickness (from the gingival margin until 3–

4 mm of bony exposure) and split-thickness (beyond the mucogingival junction) thickness flap. Muscle insertions in the flap were eliminated apically to the bony exposure to move the flap passively in a coronal direction. the root surface was mechanically treated with the use of curettes, but only in the area corresponding to the loss of clinical attachment, in order to avoid possible damage to residual connective tissue fibers still inserted into the root cementum. The facial soft tissue of the anatomic papillae coronally to the horizontal incisions was de-epithelized. the flap was sutured using a combination of sling (at the level of interdental papillae) and single (at the level of vertical incisions) sutures. Care was taken to position the soft tissue coronally to the cemento–enamel junction in order to counteract physiological shrinkage during healing. De Sanctis&Zucchelli tested this modified coronally advanced flap in a case-series study of single gingival recessions and found a degree of root coverage in 97% of the study sites and complete root coverage in 85%.

In recent decades, the addition of a connective tissue graft under the pedicle flap has been suggested as a highly predictable approach to obtain root coverage.

Different flap/graft size modifications have been described, including an ‘envelope’ approach to position the graft over the exposed root, a repositioned flap with an epithelial-connective and partially exposed graft, and coronally advanced flaps with or without vertical release incisions, or double papilla flapsfor covering the connective tissue graft. The use of a connective tissue graft in conjunction with a coronally advanced flap procedure was accepted as a reliable method to obtain root coverage and improve esthetics. After flap elevation and the elimination of all muscle insertions, a connective tissue graft was harvested from the palate. The dimension

of the graft should be approximately 3 mm larger than the dehiscence area and have a thickness of approximately 1 mm. The connective tissue graft should be stabilized slightly apical to the cemento–enamel junction by single and/or crossed resorbable sutures engaging the lateral/apical periosteum. The flap is then coronally advanced to cover the graft completely and is sutured by a combination of sling and single sutures.

Zucchelli et al. (22) compared this procedure with a similar technique in which a thick graft exceeding the dimension of the dehiscence was placed under the flap. The two bilaminar procedures resulted in similar root coverage, but the modified coronally advanced flap technique yielded better esthetic and postoperative outcomes.

The need for a second surgical site and high operator skills are constraining factors for tissue grafting with the coronally advanced flap technique and thus *various biomaterials/membranes* have been proposed in lieu of genuine tissue grafts. *Barrier membranes (guided tissue regeneration)* have been used extensively in past decades to regenerate connective tissue attachment with gingival recessions (23). However, membrane exposure and infection were frequent complications that reduced the clinical benefit and applicability in modern periodontal plastic surgery.

Enamel matrix derivative plus coronally advanced flap was applied for root coverage to improve the level of the gingival margin and obtain periodontal regeneration along the root (24). *Collagen matrix* placed under a coronally advanced flap was recently used for root coverage. Further studies are necessary to determine the potential benefit of combining collagen matrix with a coronally advanced flap. Root coverage with the addition of *acellular dermal matrix* (an allograft of cadaveric

origin applied under a coronally advanced flap) was tested in different clinical trials. The free gingival graft is the most effective procedure to obtain gingival augmentation at sites with a minimal amount of keratinized tissue. Great variability in outcome is reported when using free gingival graft for root coverage, probably because of inadequate blood supply when the free gingival flap is placed over an exposed root. An improvement in clinical outcome may be expected if applying a very thick and large graft, which is able to capture a large blood supply from the periosteum adjacent to the dehiscence area. The gingival margin position over the root surface may gradually improve over time through ‘creeping attachment’, which connotes the process of coronal migration of the long-junctional epithelium over the root. Free gingival graft may also be applied using the two-stage technique, which includes initial augmentation of gingiva apically to the recession area and coronally advanced flap surgery 3 months later. This technique allows for a reduction of the original graft size. However, scar tissue formation at the donor site and lack of color matching at the recipient site can limit the use of free gingival graft for root coverage. A preferred area of indication for the free gingival graft is still root coverage at mandibular incisors with a minimal amount of baseline keratinized tissue.

The laterally sliding flap or laterally positioned flap was long considered the gold-standard technique for treatment of a single gingival recession when an adequate amount of keratinized tissue was available lateral to the recession site. A further modification of the original laterally positioned flap was the double papilla flap, connecting two pedicle papilla flaps over a single gingival recession.

Clinical Efficacy of Techniques for Single Recession Treatment and Long-Term Outcomes

The European Federation of Periodontology (25) performed a comprehensive systematic review to assess the clinical efficacy of periodontal plastic surgery in the treatment of localized gingival recessions, with or without interdental clinical attachment loss. The primary outcome variable was complete root coverage and the secondary outcome variables were recession reduction and keratinized tissue gain.

The main conclusions were -

Coronally advanced flap is the root-coverage method most commonly studied in randomized controlled trials.

1. Coronally advanced flap + connective tissue graft and coronally advanced flap + enamel matrix derivative produced more complete root coverage and more reduction of gingival recession than did coronally advanced flap alone.
2. Coronally advanced flap + connective tissue graft produced more root coverage at recessions with interdental clinical attachment loss than did coronally advanced flap alone.
3. Initial data suggest that coronally advanced flap + collagen matrix achieved higher recession reduction than did coronally advanced flap alone.
4. Coronally advanced flap + connective tissue graft was associated with a higher probability of complete root coverage compared with coronally advanced flap + enamel matrix derivative, coronally positioned semilunar flap, free gingival graft and laterally positioned flap.
5. Coronally advanced flap + connective tissue graft was associated with higher recession reduction compared with coronally advanced flap + barrier membrane-associated guided tissue regeneration, coronally advanced flap + enamel matrix derivative and coronally advanced flap + collagen matrix.

6. Guided tissue regeneration treatment did not improve the clinical efficacy of coronally advanced flap and was associated with a higher incidence of complications. acellular dermal matrix applied beneath a coronally advanced flap caused great variability in outcome and no significant benefit compared with the use of coronally advanced flap alone.
7. Multiple combinations rather than a single graft/ biomaterial beneath a flap usually yielded similar or less root coverage than more simple procedures.

Multiple Gingival Recession Treatment

Multiple gingival recessions are usually more challenging defects than single recession defects because the surgical field is larger with higher anatomical variability that may include prominent roots, shallow vestibules, enamel-root abrasions and unevenness in residual keratinized tissue. Also, treatment of multiple recessions must consider the total number of surgical procedures, the amount of donor tissue that can be obtained from the palate and patients' esthetic requests.

Coronally advanced flap for multiple gingival recessions

Bernimoulin et al. (9) described, in the mid1970s, a technique to treat multiple gingival recessions, which included a free gingival graft for gingival augmentation that was followed, 3 months later, by a coronal positioning of the gingival margin. Zucchelli et al. (7) made a significant modification of the original coronally advanced flap designed by Bernimoulin et al. by introducing the envelope coronally advanced flap, which eliminated the vertical-release incisions and included the following steps:

- I. Intrasulcular incisions involving at least one tooth mesial and at least one tooth distal to the teeth

showing gingival recessions. oblique incisions using a split-thickness approach at the level of the interdental soft tissue in order to elevate each surgical papilla, followed by a full-thickness flap raised until the mucogingival junction using a periosteal elevator.

- II. Mobilization of soft tissue with a horizontal suprapariosteal incision beyond the mucogingival junction in order to relieve muscular tension and allow a coronal advancement of the gingival mucosa without causing tension of any tooth.
- III. Gentle instrumentation of exposed root surfaces and de-epithelization of the interdental papillae. passively positioning the split–full–split thickness flap coronally to the cemento–enamel junction of all involved teeth and stabilizing the flap by means of sling sutures around anatomic papillae.

In a randomized controlled trial, the clinical and esthetic outcomes of the multiple coronally advanced flap, with or without vertical releasing incisions, and found no statistically significant difference between the two study groups in terms of recession reduction and clinical attachment gain. Conversely, the envelope coronally advanced flap showed more sites with complete root coverage, a greater increase in buccal keratinized tissue, fewer postoperative complications and superior esthetic outcome than the coronally advanced flap with vertical incisions. (26)

Coronally advanced flap and connective tissue graft for multiple gingival recessions

The introduction of a connective tissue graft under the coronally advanced flap constituted a significant improvement in the treatment of multiple gingival recessions. The data further showed that the placement of a connective tissue graft under a coronally advanced flap

minimizes the postoperative shrinkage of the gingival margin in the apical direction. (27)

Allograft and replacement biomaterials

Various allografts or replacement biomaterials have been used under a coronally advanced flap instead of a connective tissue graft in order to reduce patient morbidity. Enamel matrix derivative was tested for possible benefits in the treatment of multiple gingival recessions using the coronally advanced flap technique (28). A randomized controlled trial of multiple gingival recessions found that the addition of acellular dermal matrix under a coronally advanced flap yielded significantly more root coverage than a coronally advanced flap used alone (29).

Tunnel techniques for multiple gingival recessions

The tunnel procedure for root coverage includes intrasulcular incisions and a split-thickness flap design beyond the mucogingival junction, leaving the interdental papillae intact, followed by graft insertion. Zabalegui et al. (30) presented details of the surgical procedure:

- I. The tunnel is prepared with a split-thickness incision at each area of recession involved in the procedure.
- II. Care is taken to undermine the tissue beyond the mucogingival junction in order to obtain a tension-free tunnel, allowing the insertion of the graft.
- III. A delicate incision is performed at the level of interdental papillae, which are gently raised without detaching the tip of the papillae.
- IV. A graft is harvested from the palate, extending from the canine area to the tuberosity, to obtain a graft long enough to achieve root coverage of all involved teeth.
- V. The graft is then inserted into the tunnel by applying a specific suture technique.

- VI. The first suture is inserted throughout the most distal recession part and the needle exits in the most medial part of the recession.
- VII. The second suture is placed at the opposite side and the needle exits at the same medial recession.
- VIII. The graft detained by both sutures (mesial and distal) is gently moved into the tunnel, sliding under the interdental papillae.
- IX. Specific instruments may help in adapting the graft into the tunnel.
- X. When the graft achieves the desired position, both sutures are closed with knots to stabilize the inserted graft.
- XI. The graft is exposed in the area of recession.

A modification of the original tunnel technique covers the graft by a coronal position of the gingival margin, using double-crossed sutures to move the gingival margin coronally and stabilize the graft at the crowns by temporary resin stops (31).

Esthetic outcomes of periodontal plastic surgery

Classical mucogingival surgery aims to improve the amount of attached gingiva in order to prevent further progression of the gingival recession, which was considered previously to be related to frictional forces during mastication. Early techniques used bone denudation or periosteal retention to improve the mucogingival anatomy, but these treatments were gradually abandoned after the introduction of the free gingival graft treatment (32). However, these grafting techniques were frequently associated with a low amount of root coverage and poor esthetic outcomes. The introduction of modern surgical procedures in the late 1980s, along with the increased attention to esthetic periodontics, opened a new era in periodontal treatment, which focused not only on the reconstruction of an

‘adequate’ amount of attached gingiva, but also on obtaining root coverage to enhance soft-tissue esthetics. The concept of periodontal plastic surgery was then introduced, which has remained an important part of contemporary periodontal treatment. Even though complete root coverage remains the main goal of periodontal plastic surgery, a mere assessment of the level of the gingival margin post-surgery may not be adequate to evaluate the overall esthetic outcome. In fact, esthetic failure of plastic surgery may occur in cases of partial root coverage, as well as with poor gingival color match, misalignment of the mucogingival junction and keloid-like tissue texture.

The root coverage esthetic score at the professional level has also been introduced. The root coverage five-point esthetic scoring system assesses the amount of root coverage (primary variable), marginal tissue contour, soft-tissue texture, mucogingival junction alignment and gingival color, as follows:

1. Gingival Margin Position

- a. zero points = failure to obtain root coverage (gingival margin apical or equal to the baseline recession);
- b. 3 points = partial root coverage;
- c. 6 points = complete root coverage.

2. Marginal Tissue Contour

- a. zero points = irregular gingival margin (does not follow the cemento–enamel junction);
- b. 1 point = proper marginal contour/scalloped gingival margin (follows the cemento–enamel junction).

3. Soft-Tissue Texture

- a. zero points = scar formation and/or keloid-like appearance;
- b. 1 point = absence of scar or keloid formation.

4. Mucogingival Junction Alignment

- a. zero points = mucogingival junction not aligned with the mucogingival junction of adjacent teeth;
- b. 1 point = mucogingival junction aligned with the mucogingival junction of adjacent teeth.

5. Gingival Color

- a. zero points = color of tissue varies from the gingival color at adjacent teeth;
- b. 1 point = normal color and integration with the adjacent soft tissues.

Ten points is the ideal esthetic score. Zero points is assigned if the final position of the gingival margin is equal or apical to the previous recession depth (failure to achieve root coverage), irrespective of color, the presence of scar tissue or other secondary outcomes. Zero points is also assigned if a partial or total loss of interdental papilla (black triangle) occurs following treatment (33).

Conclusion

- This review shows that periodontal plastic surgery procedures for root coverage are important techniques in Periodontics. The following conclusions can be drawn:
- The coronally advanced flap design for treatment of single recessions is supported by the highest level of evidence compared with other designs.
- The coronally advanced flap + connective tissue graft for root coverage of single and multiple recessions provides the most optimal clinical outcome.
- Flap tension, flap thickness and graft dimension can influence treatment outcome.
- Root-coverage treatment may prevent further progression of gingival recessions, but traumatic toothbrushing may still lead to recession recurrence.
- The tunnel procedure is a promising treatment of multiple recessions.

- A highly esthetic outcome of periodontal treatment at both the professional and the patient level is a major goal of modern periodontics.

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