

## Gingival Recessions: Etiology and Classification

Gingival recessions are defined as the displacement of the soft tissue margin apical to the cemento-enamel junction (CEJ), and they constitute a frequent clinical feature in the general population. Evidence suggests that the predominant cause for localized recessions in young individuals is tooth-brushing trauma, while periodontal disease may be the primary cause in older adults. Some predisposing and precipitating factors can be identified.

Predisposing factors:

- Insufficient attached gingiva
- Aberrant frenulum
- Decreased vestibular depth
- Thin phenotype
- Root prominence
- Tooth malposition causing bone dehiscence or fenestration

Precipitating factors:

- Plaque-induced inflammation
- Traumatic brushing/flossing
- Iatrogenic factors
- Occlusal trauma (controversial)
- Habits/piercings

It is of primary importance to diagnose the etiology of the recession to halt its progression. In contrast, a proper classi-

**Table 38.1** The Miller classification for gingival recessions

Class I	Doesn't extend to the MGJ; no periodontal loss in the interdental area	100% root coverage
Class II	Extends to or beyond the MGJ; no periodontal loss in the interdental area	100% root coverage
Class III	Extends to or beyond the MGJ; bone or soft tissue loss in the interdental area or malposition of the teeth	Partial root coverage can be anticipated
Class IV	Extends to or beyond the MGJ; severe bone or soft tissue loss in the interdental area and/or malposition of the teeth	Root coverage cannot be anticipated

fication could help the practitioner to decide the correct treatment for the recession. Thus, many classifications have been used for this purpose. Miller in 1985 [1] described one of the most frequently used classifications of recessions (Table 38.1). It is based on the mucogingival junction (MGJ) position, mesial and distal periodontal loss (bone or soft tissue), and tooth malposition. It also assesses how predictable the mucogingival procedures are in terms of root coverage depending on each recession (Fig. 38.1).

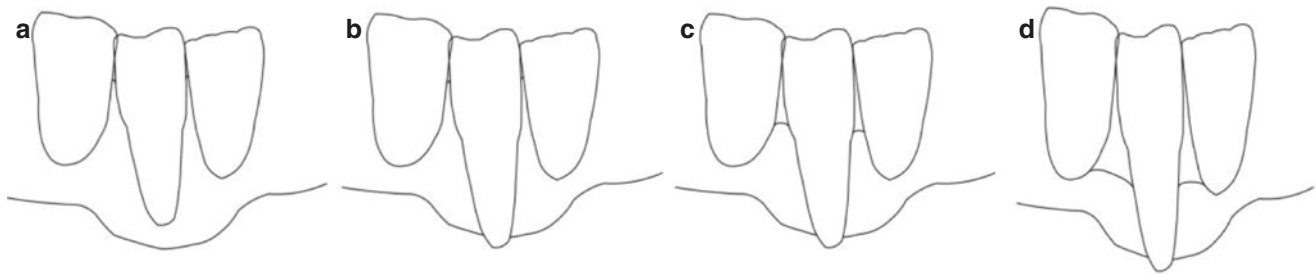
The classification of Cairo 2011 [2] is based on the interproximal attachment loss. Since the World Workshop of 2017, this classification was stated as the main instrument to name gingival recessions (Table 38.2) (Fig. 38.2).

## Historical Timeline of Soft Tissue Plastic Surgery

Originally proposed by Friedman in 1957 [3], “mucogingival surgery” was defined as any surgery designed to preserve attached gingiva, remove frena or muscle attachment, and increase the depth of the vestibule. Back then, it was believed that a minimum amount of attached gingiva was needed for the maintenance of gingival health around teeth. Multiple studies [4–6] showed that gingival health could be maintained independently of its dimensions and that there was a lack of association between the width of the attached gingiva

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**Fig. 38.1** The Miller classification for gingival recessions. (a) Class I, (b) Class II, (c) Class III, (d) Class IV

**Table 38.2** The Cairo classification for gingival recessions

RT1	No loss of interproximal attachment; interproximal CEJ not detectable mesially and distally	100% root coverage
RT2	Loss of interproximal attachment; the amount of interproximal attachment loss less or equal to the buccal attachment loss	100% root coverage, different procedures
RT3	Loss of interproximal attachment; the amount of interproximal attachment loss is greater than the buccal attachment loss	Full root coverage not achieved

and the development of soft tissue recession in the presence of adequate oral hygiene measures [7]. With time, one important application of this type of surgery became treating gingival recessions. The term “mucogingival surgery” was thus replaced by “soft tissue plastic surgery” by the American Academy of Periodontology [8] since it englobed treating defects in the morphology, position, or amount of gingiva.

This chapter will showcase the most important soft tissue plastic surgery techniques.

Sullivan and Atkins in 1968 [9] explained how to prepare the recipient and donor sites while performing an autogenous free gingival graft (Fig. 38.3). The recipient site preparation procedure includes a horizontal incision at the level of the mucogingival junction extending mesially and distally to the concerned tooth and two vertical incisions connecting the horizontal incision. Sharp dissection of the epithelium, connective tissue, and muscle fibers is then performed down to the periosteum. The recipient bed’s surface should be smooth to prevent clot formation in irregularities, which could prevent graft survival in the plasmatic stage. The donor site preparation consists of harvesting an autogenous graft from the palate, which is then immobilized on the recipient bed with sutures. This palatal graft is then closely secured to the recipient bed by interrupted sutures and a sling suture anchoring into the apical periosteum and aiding in the compression of the graft to prevent any movement and the forma-

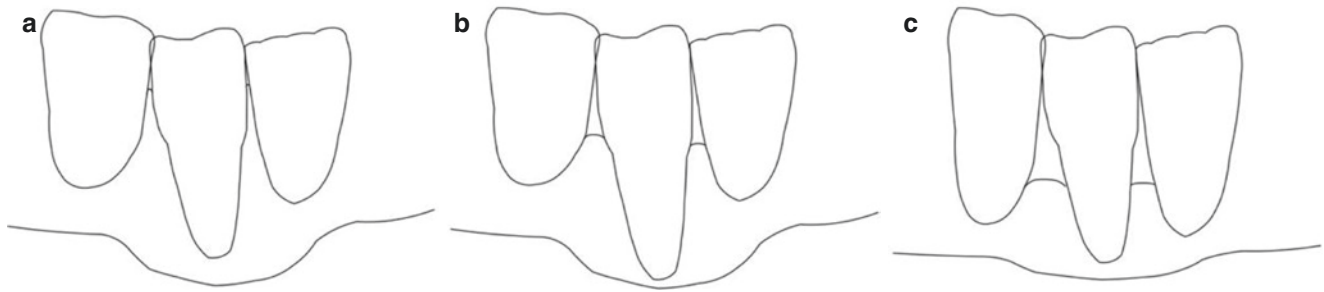
tion of a coagulum separating the graft from the recipient bed.

The graft’s thickness will determine its behavior during healing and its ultimate character; thick grafts having more primary contraction and less secondary contraction than thin grafts.

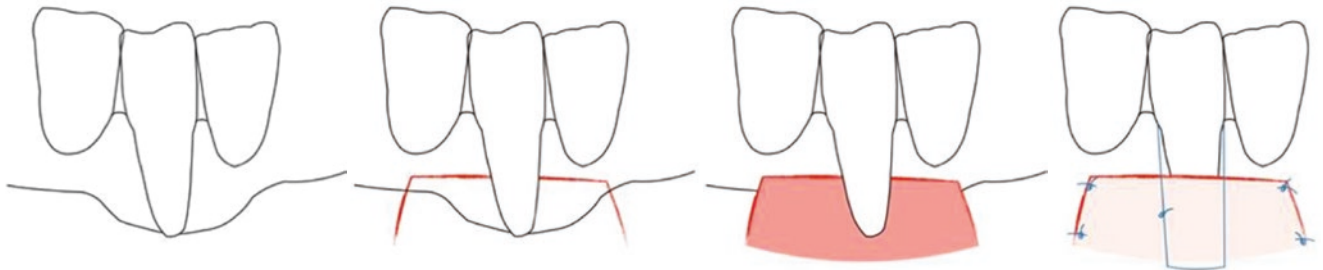
Tips and tricks for a free gingival graft procedure:

- The recipient bed should be thin in order to prevent mobility and thus necrosis.
- To make sure the recipient bed is not mobile, grab the lower lip and move it laterally: if mobility is seen, dissect the remaining muscle attachments.
- Although it is generally used for increasing the amount of keratinized tissue, a free gingival graft can also be used to partially cover recessions; in that scenario, the horizontal incision is made more coronally than usual.

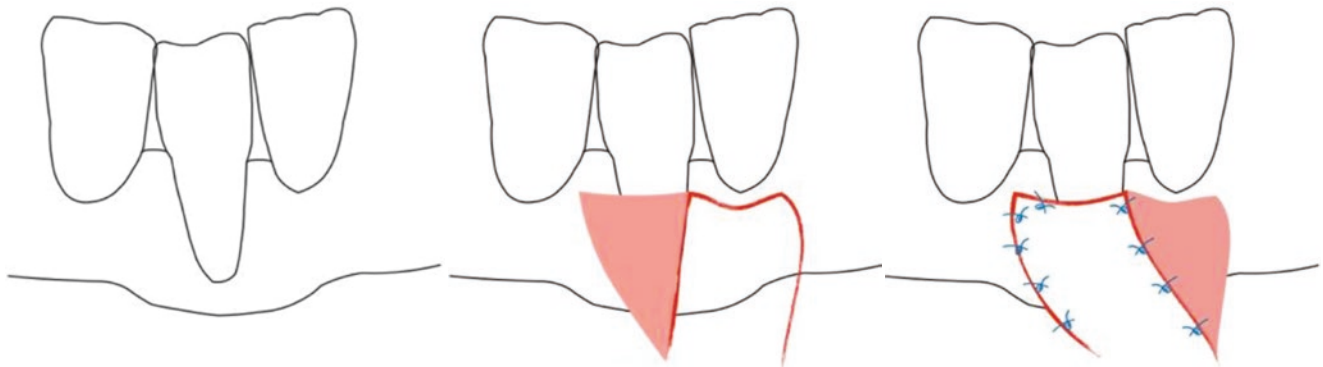
Pedicle flaps consist of the repositioning of a flap either laterally or coronally. Grupe and Warren proposed laterally positioned flaps in 1956 [10]. This technique is indicated to treat single tooth recessions in cases where sufficiently high and thick keratinized tissue is available from the adjacent area. The recipient site preparation consists of performing a horizontal incision at the level of the CEJ of the concerned tooth, connected to a vertical incision that is parallel to the mesial gingival margin of the recession extending in the alveolar mucosa. The area marked by these incisions is then de-epithelized. The flap preparation consists of a beveled intrasulcular incision along the distal gingival margin of the recession defect and extending in alveolar mucosa, connected to a submarginal horizontal incision at the donor tooth site, preserving at least 1 mm of attached gingiva, followed by an oblique vertical incision extending into alveolar mucosa. Flap elevation is performed by a split-thickness approach ensuring passive placement of the flap laterally on the exposed root surface. Interrupted sutures are then used to



**Fig. 38.2** The Cairo classification for gingival recessions. (a) RT1, (b) RT2, (c) RT3



**Fig. 38.3** The free gingival graft procedure



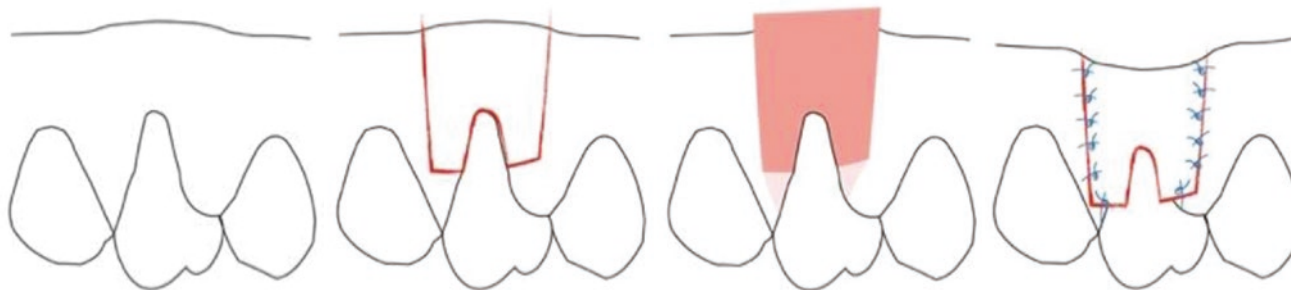
**Fig. 38.4** The laterally positioned flap

secure the flap in the desired position mesially and distally, followed by a marginal sling suture in order to advance the flap (Fig. 38.4) coronally.

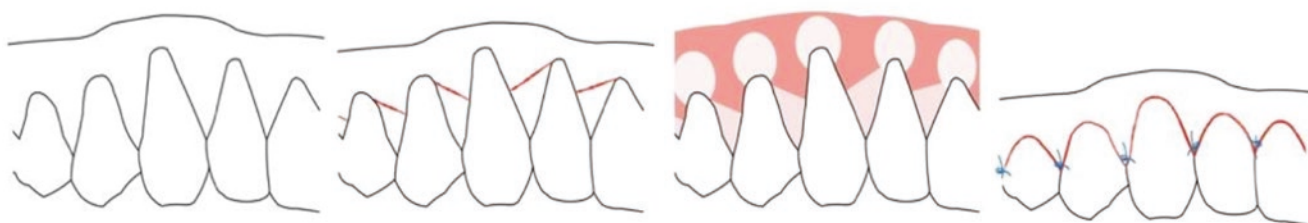
Tips and tricks for a laterally positioned flap procedure:

- The horizontal incision in the recipient site should be 3 mm, while the submarginal horizontal incision should be 6 mm more than the recession width measured at the CEJ.
- Start performing the interrupted sutures from the most apical extension of the vertical releasing incisions, proceeding coronally, in order to shift the flap coronally and to release tension.

Coronally advanced flaps were first proposed by Allen and Miller in 1989 [11] to treat shallow recessions. The technique consists of performing two vertical incisions at the concerning tooth's line angles and raising a split-thickness



**Fig. 38.5** The trapezoidal flap for single recessions



**Fig. 38.6** The envelope flap for multiple recessions

flap, which is then coronally advanced and secured at the cemento-enamel junction (CEJ) with sutures. This technique was further developed by de Sanctis and Zucchelli in 2007 [12]. It included two horizontal beveled incisions, mesial and distal to the recession defect, and two beveled oblique incisions coming from these, extending to the alveolar mucosa. The flap is then raised with a split–full–split–thickness approach. After de-epithelizing the anatomical papillae, the flap is coronally advanced, and the vertical incisions are sutured. The surgical papillae are secured to the underlying bed with a sling suture (Fig. 38.5).

The same concept may be applied to multiple recessions, using a flap design to cover all recessions in the same session. The envelope flap by Zucchelli and De Sanctis [13] consists of creating submarginal and intrasulcular incisions, going from the tooth that is considered the center of rotation in the surgical papilla rotating towards the ends of the flap during the coronal advancement (Fig. 38.6).

Tips and tricks for a coronally advanced flap procedure:

- Make sure the flap is completely passive and is stable in its final position even without the sutures.
- Perform two types of split incisions apically: a deep one parallel to the bone and a superficial one parallel to the flap where the blade is seen by transparency. This permits to advance the flap coronally.

The coronally advanced flap yields good clinical outcomes in terms of complete root coverage; however, more stability is achieved by combining it with a connective tissue

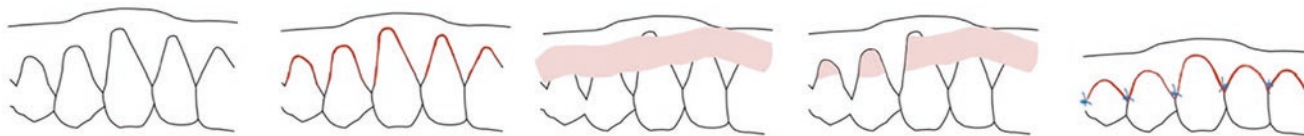
graft. These are called bilaminar techniques and can be used for single or multiple recessions, using the same flap designs and only adding a connective tissue graft that is sutured to the prepared recipient bed.

One of the most important techniques that combine the use of a connective tissue graft is the tunnel technique. Inspired by Raetzke, who published in 1985 [14] his “envelope technique” for single recessions, and by Zabalegui in 1999 [15] for multiple recessions, the technique further evolved with Aroca in 2010 [16] to include a coronal advancement and permit better root coverage and aesthetic outcomes.

This modified tunnel technique consists of performing intrasulcular incisions without reaching the papillae, followed by a mucoperiosteal dissection extending beyond the mucogingival junction and under each papilla so that the flap can be moved in a coronal direction without tension. Muscle fibers and any remaining collagen bundles on the inner aspect of the flap alveolar mucosa are cut using specific tunnel instruments with extreme care to avoid perforation of the flap and obtain a passive coronal positioning of the flap and the papilla. The harvested connective tissue graft is then inserted in the prepared tunnel and sutured at the level of the CEJ, followed by a coronal advancement of the “flap” and suturing with a sling or horizontal mattress sutures around the contact points aided by composite stops (Fig. 38.7).

Tips and tricks for a tunnel procedure:

- Make sure the “flap” is completely passive before inserting the connective tissue graft.



**Fig. 38.7** The tunnel procedure

- When placing the graft, make sure to place it at the level of the CEJ and prevent its apical migration by suturing each edge.

## Basic Principles of Mucogingival Surgery

Irrespective of the differences in techniques, indications, and surgical designs, there are some basic principles that should be respected in every soft tissue plastic surgery to ensure successful healing and optimal treatment outcomes and prevent undesired complications.

### Preoperative Phase

When deciding if the patient is a good candidate for soft tissue plastic surgery, the most important factors to consider are plaque control and tobacco habit. If not controlled, these two factors will severely affect the optimal outcome of any surgical technique.

### Flap Preparation

According to Burkhardt 2014 [17], some recommendations related to an ideal flap preparation can be made:

- Incise the sulcular area around teeth and avoid marginal and paramarginal incisions.
- Place midcrestal incisions in edentulous areas.
- Avoid releasing incisions.
- If a releasing incision is required, carry it out as short and as medially as possible.
- Do not place releasing incisions on the buccal root prominences.

It is also important to use a microsurgical approach, minimally elevating the flaps and ensuring a primary closure in the interdental area.

The flap thickness is an essential factor to consider since thick gingival tissue eases manipulation, maintains vascularity, and promotes wound healing during and after surgery.

Moreover, thinner flaps are associated with inferior root coverage outcomes.

### Flap Mobilization

Flap tension and the precision of flap margin adaptation influence the extension and severity of scar formation due to primary or second intention healing. Buccal releasing incisions impair the blood supply of the flap and decrease its stability.

### Flap Adaptation

Stabilization of the soft tissues covering the wound area with appropriate suturing appears to be a key prerequisite for optimal surgical outcomes. Thinner sutures (6-0 or 7-0) are preferred since they do not lead to tissue tear. Sutures should remain as little as needed to assure the healing wound's stability, depending on the individual situation rather than a stereotype regime.

### Postoperative Care

The use of chlorhexidine following periodontal surgery represents a fundamental concept contributing to the reduction of the infective burden in the oral cavity and, hence, the promotion of oral postsurgical health. Moreover, optimal oral hygiene standards are even more important in periodontal plastic surgery.

### Autologous Grafts vs. Substitutes

As mentioned above, bilaminar techniques, combining a connective tissue graft, compared to pedicle flaps alone, result in better stability of the gingival margin over time. The connective tissue graft can be harvested from various donor sites, most frequently the palate and the maxillary tuberosity area, and this results in different clinical and histological characteristics of the grafts. The main differences are shown in the table below (Table 38.3).

**Table 38.3** Main histological and clinical characteristics of connective tissue grafts harvested from the palate and the tuberosity

	Palate	Tuberosity
Histological characteristics	Lamina propria is loose and more vascularized	Lamina propria is denser and poorly vascularized
	More submucosa	Less submucosa
Clinical characteristics	Higher primary contraction	Hyperplastic tendency

It is also noteworthy to consider the morbidity of the surgery since harvesting a graft from the palate results in higher postoperative pain and anti-inflammatory consumption, along with higher chair time. Regarding the different graft donor sites, better esthetic outcomes in terms of color blending, volume, and texture have resulted from a connective tissue graft harvested from the palate.

Various techniques exist to harvest a connective tissue graft from the palate; the most important ones are the de-epithelized free gingival graft and the subepithelial connective tissue graft. With the first technique, a free gingival graft is harvested traditionally and de-epithelized outside of the mouth. This procedure yields higher tissue quality since the part directly in contact with the epithelium has the highest connective tissue quality. Care must be taken to completely remove the epithelium in order to prevent the formation of epithelial cysts. This harvesting technique results in secondary intention healing at the palate and might lead to higher postoperative pain and bleeding. On the other hand, the subepithelial connective tissue graft harvesting technique consists of directly harvesting the connective tissue beneath the epithelium, also known as lamina propria. With this method, we aim for a primary intention healing at the palate and consequently less patient morbidity.

The use of an autogenous connective tissue graft harvested from the palate or the tuberosity constitutes the “gold standard” for optimal root coverage outcomes. However, it entails a second surgical site and higher patient morbidity. The use of substitutes may counteract this limitation. Allogenic and xenogeneic grafts have been used in root coverage procedures. Acellular dermal matrix grafts primarily and xenogeneic collagen matrix secondly may be considered as alternatives in cases where subepithelial connective tissue grafts harvested from the palate could not be used. In terms of complete root coverage percentage, they yield inferior treatment outcomes.

## Surgery on Teeth vs. Implants

Similar soft tissue plastic surgery techniques can be performed on implants aimed mainly at increasing the amount of keratinized mucosa, increasing the thickness of the soft

tissues around implants, and treating buccal soft tissue deficiencies.

The main anatomical difference between teeth and implants affecting the soft tissue healing is the vascularization: around teeth, the vascularization of the gingiva is ensured by the periodontal ligament, the supra-periosteal vessels, and the alveolar bone blood vessels, while around implants, since there is no periodontal ligament, the mucosa receives its blood supply only from the supra-periosteal vessels and the alveolar bone blood vessels.

This difference in the vascularization might be the origin of the frequently observed higher contraction rate of free gingival grafts around implants compared to teeth.

Some clinicians recommend using connective tissue grafts harvested from the tuberosity to counteract this contraction when performing a soft tissue augmentation around implants.

## Conclusion

Performing soft tissue plastic surgery around teeth and implants needs a correct diagnosis, an adequate decision-making process to choose the indicated root coverage procedure and proper surgical know-how. With the advancement of technology, a shift will be witnessed towards more minimally invasive techniques using specialized microsurgical instruments. Site-specific and technique-related characteristics are of utmost importance. However, patient-related outcomes should not be forgotten. In fact, periodontal plastic surgery’s objective is achieving patient aesthetics with the least morbidity possible and the best prognosis.

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