

Surgical Treatment Options for Grafting Areas of Gingival Recession Association with Cervical Lesions: A Review

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ABSTRACT

Statement of the Problem: Gingival recession (GR) is a highly prevalent dental problem that may be associated with dentin hypersensitivity and aesthetic complaint. Furthermore, GR is often complicated by dental cervical wear of substance, such as erosion, abrasion, or abfraction lesions, as well as initial or more extensive carious involvement of the cervical area, which worsen the symptoms and make the treatment of this periodontal condition more challenging.

The Purpose of the Study: To provide an overview of surgical treatment options presented in the literature for sites affected by GR with carious cervical lesions (CCLs) or non-carious cervical lesions (NCCLs).

Methods: The Medline database was searched for items dealing with GR and its treatment options, especially on GR associated with CCLs or NCCLs.

Results: Several periodontal surgical techniques have shown good potential for treating GR over the years. Specifically, considering GR associated with CCL or NCCL, an assessment of both hard (dental) and soft (gingival) tissue characteristics of the involved site is recommended in selecting the surgical procedure.

Conclusions: For GR associated with CCL or NCCL, hard and soft tissue characteristics of the involved site have to be carefully evaluated in order to choose the most appropriate surgical procedure.

CLINICAL SIGNIFICANCE

A structured decision-making process, considering both hard and soft tissue characteristics of the involved site, is recommended in choosing the most appropriate surgical procedures to treat GR associated with CCL or NCCL defects. The *restitutio ad integrum* of the dento-periodontal unit is an essential condition to restore the tooth to its original function and esthetics.

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GINGIVAL RECESSION

Gingival recession (GR) is defined as “the apical migration of the gingival margin beyond the cemento-enamel junction,”¹ and is a highly prevalent condition in patients with either high^{2,3} or poor^{4,5} oral hygiene standard.

Miller classified GR according to both the level of gingival margin in relation to the muco-gingival

junction (MGJ) and the degree of interproximal attachment level⁶ as significant variables to predict the likelihood of complete root coverage (CRC) after surgical treatment.

On the basis of this classification, in patients with no history of periodontitis, and Miller I or Miller II GR defects, there is high chance to achieve *complete root coverage after periodontal plastic surgery*.⁶ Conversely, in Miller Class III or IV GR, the loss of interdental

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periodontal support limits the maximum root coverage (MRC) surgically achievable.

Zucchelli and colleagues⁷ implemented and improved this prognostic method considering the discrepancy between the ideal and the real vertical dimension of the interdental papilla as a relevant prognostic factor. Specifically, the ideal dimension of the interdental papilla is shifted apically on both mesial and distal sides, from the tip of the respective real papilla, identifying two angular points that, connected with a scalloped line, predetermine the expected post-surgical gingival margin (Figures 1 and 2).

NON-CARIOUS CERVICAL LESIONS

Frequently, GR is associated with non-carious cervical lesions (NCCLs), defined as the loss of

substance along the gingival margin of the tooth, due to mechanical abrasion, erosion, or abfraction.⁸

Root surface abrasion appears as a well demarcated area with hard and smooth surface, typically caused by repeated mechanical trauma from toothbrushing; root surface erosion is an undemarcated, hard, and quite smooth area, where acids from food and drink or gastric acids have partly eroded the mineral surface; abfraction of the root surface seems to be the consequence of tooth bending and strain due to eccentric occlusal forces.⁹ Pini Prato and colleagues observed 1,010 GR defects and reported that only 46% of the considered root surfaces were intact, with an identifiable cementoenamel junction (CEJ) and absence of “step” from cervical wear of substance.¹⁰

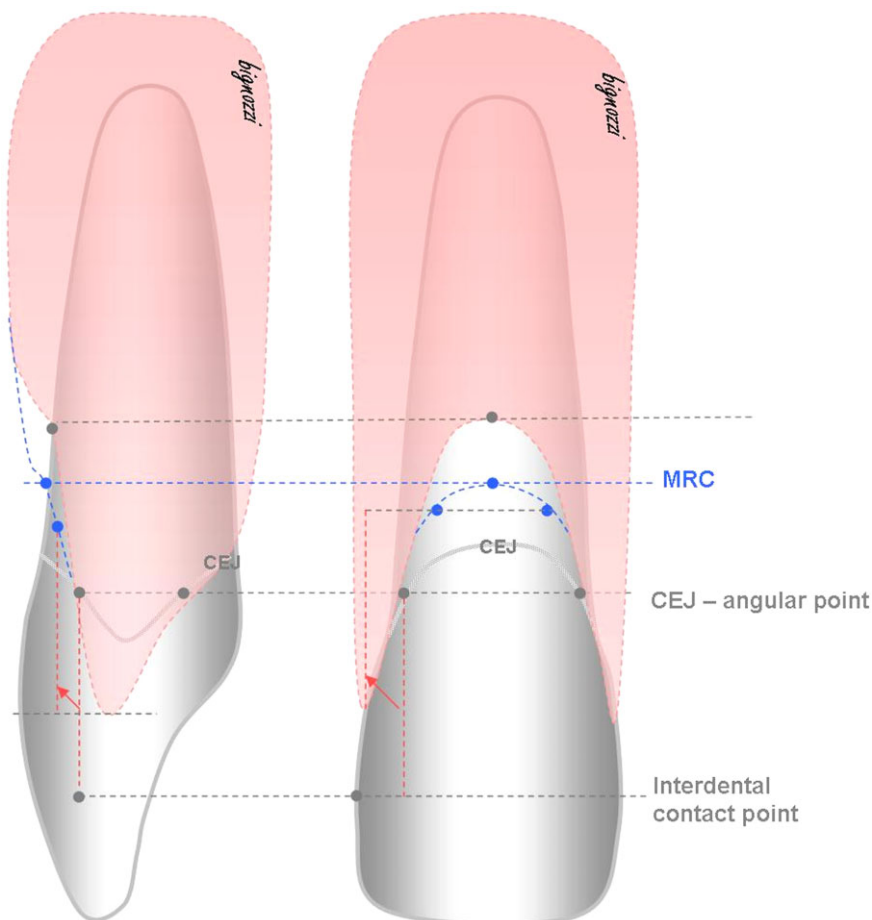


FIGURE 1. Identification of maximum root coverage (MRC).⁷ The ideal interdental papilla is identified as the distance between the contact point and the cementoenamel junction (CEJ) angular point. This measurement is shifted apically, from the tip of the real papilla, parallel to the long axis of the tooth. This point is projected on the recession margin identifying two symmetrical points that, connected with a scalloped line, provide the expected line of MRC. The MRC, assumed as putative CEJ, becomes the apico-coronal point of reference in determining the perio-restorative plan in gingival recession defects associated with non-carious cervical lesions.

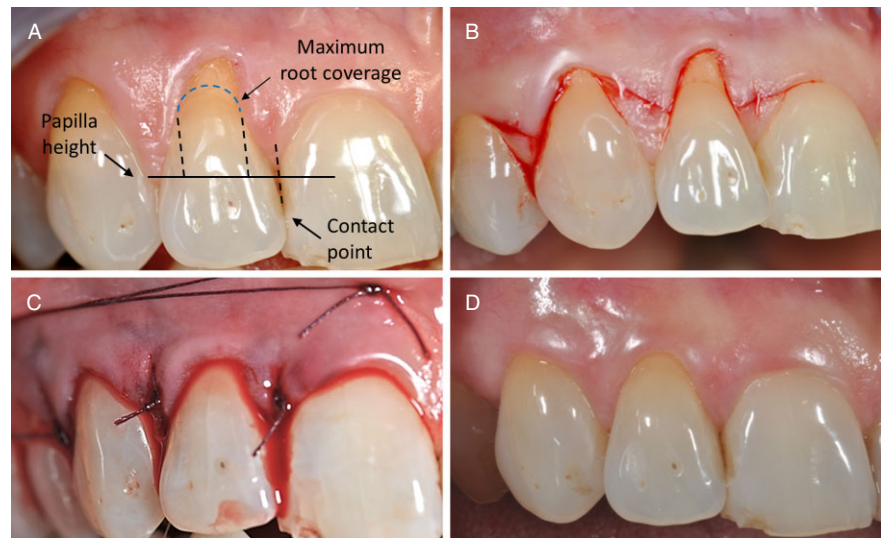


FIGURE 2. Predetermination of maximum root coverage (MRC) achievable after coronally advanced flap (CAF) procedure. MRC is determined based on the height of the interdental papilla. A, Preoperative evaluation of maxillary right lateral incisor and canine. B, CAF incisions. C, Sutures. D, Healing 6 months after surgery.

RESTORATIVE THERAPEUTIC ISSUES

It is widely recognized that the potential of cervical lesions to evolve over time, affecting dental pulp and marginal periodontal tissue, as well as root sensitivity and associated compromised aesthetics, requires an early and comprehensive therapeutic approach.¹¹ It should be noted that in the cervical area, the difficulties in access and field isolation, the microstructural characteristics of enamel and dentin, unsuitability as substrate for adhesion,¹² the concentration of biomechanical stress,¹³ and the spatial relationship with marginal periodontium may make it difficult to obtain a perfect marginal seal and long-term success of the composite restoration. These clinical concerns are common to both carious cervical lesion (CCL) and NCCL, topics for which the reader is referred to more specific sources.^{14,15} For the purposes of this review, it is important to emphasize that the aforementioned difficulties with, and questionable long-term outcomes^{12–14} of, restorative approaches to treating both CCL and NCCL defects have resulted in a greater emphasis on efforts to restore the original soft and hard tissue relationships and structure by means of periodontal or combined perio-restorative interventions.

ROOT COVERAGE

When localized non-inflammatory GR defects are present, site-specific periodontal therapy is feasible in the form of root coverage. Since the late 1960s, several periodontal surgical techniques have shown good potential for root coverage; they include the epithelialized¹⁶ or partially epithelialized¹⁷ free gingival graft (FGG, PE-FGG), the pedicle flaps such as the double papilla flap (DPF),¹⁸ the laterally sliding flap preceded by an osteoperiosteal stimulation,¹⁹ the laterally advanced flap (LAF)^{20,21} and the coronally advanced flap (CAF),^{22–24} the subpedicle connective tissue graft (CTG),²⁵ and combinations thereof (e.g., CTG and CAF).^{26,27} Other approaches have been suggested, in combination with CAF, such as the use of enamel matrix derivative (EMD),^{28,29} non-resorbable^{30,31} or resorbable^{32,33} barrier membranes, acellular dermal matrix allograft,³⁴ xenogenic collagen matrix (CM),^{35,36} platelet-rich plasma (PRP),^{37,38} and living tissue-engineered, human fibroblast-derived dermal substitute (HF-DDS).³⁹

The available evidence, stemming from several systematic reviews^{40–42} seems to indicate that CTG and CAF, alone or in combination, are the most predictable cost-effective techniques to obtain CRC.

Nevertheless, very limited data are available in the literature for certain root coverage techniques, such as FGG or PE-FGG and pedicle flaps other than CAF, as well as for CAF enhanced with PRP, HF-DDS, or CM.

Even more, when multiple treatment options are available for the same clinical condition, the number of possible pairwise comparisons increases exponentially, and some of these may not be available from existing trials. These limitations may make meta-analyses difficult and prevent conclusive evidence-based statements about the treatment of choice. Recently, to partly overcome these concerns, Buti and colleagues⁴³ considered all the existing CAF-based root coverage techniques through a Bayesian network meta-analysis, where the data extracted from single randomized controlled trial (RCT) were combined in a network of direct (available) or indirect (possible) comparisons among the different treatments. This permitted to make inference even on comparisons not directly conducted in RCTs, to perform a ranking in efficacy, and to assess the probability of each treatment option as the best for the single considered main outcome, that is CRC, GR reduction, clinical attachment level gain, keratinized tissue (KT) gain.

Indeed, the real starting point for building a decision tree aimed at determining the “best” treatment should be to set the main desired outcome. The final choice of treatment should result from several considerations, concerning not only the estimated efficacy, but also the number of available focused studies, as well as possible risks and benefits of each candidate therapy in the specific case (Figure 3).

ROOT COVERAGE OF GR COMPLICATED BY CERVICAL LESION

Root coverage outcomes of CAF, CTG, or their combination can be compromised by the presence of cervical lesions (CLs) with considerable loss of cervical tooth structure, referred to as “step.”¹⁰ The reason for the poorer outcomes in the presence of a “step” is the technical difficulty of repositioning the flap (or

positioning the graft) on an irregular surface with marked concavity or sharp edges. Because of this, Pini Prato and colleagues¹⁰ stressed the need to clinically evaluate GR defects by completing the Miller classification along with an accurate assessment of the extent of root surface hard tissue discrepancy.

CLs may involve only the anatomic crown of the tooth or only the root surface. These two cases can be resolved by merely providing a restorative or mucogingival treatment, respectively. However, more frequently, the cervical lesion involves both crown and root, making the CEJ less readily identifiable;⁷ this means that the main anatomical landmark needed for a combined perio-restorative approach is missing. In order to overcome this problem, the prognostic method of Zucchelli and colleagues^{7,44} makes it possible to predetermine the MRC achievable with mucogingival procedures by measuring the level of residual interdental periodontal support in relation to the ideal height of the interdental papilla, as previously reported and illustrated in Figures 1 and 2.

This presurgical assessment procedure was proposed specifically for recessions associated with NCCLs,⁷ but it may be considered clinically useful also for GR defects associated with initial CCLs, and the anatomical landmark to be considered in relation to the periodontal surgical approach may again be MRC. Indeed, also previously carious roots with shallow involvement of the cervical area, once planed and cleaned from all carious dentin and/or any present restoration material, seem to respond favorably to surgical root coverage with CTG⁴⁵ or CAF,⁴⁶ with equally predictable results to those obtained on intact roots.^{47–49}

TECHNICAL PROCEDURES

MRC becomes the primary anatomical landmark that conceptually replaces the missing CEJ and indicates the appropriate apical finish level for composite restoration. This procedure, which allows prediction of the final level of root coverage,⁴⁴ enables the clinician to perform restorative treatment prior to surgery, that is in a dry

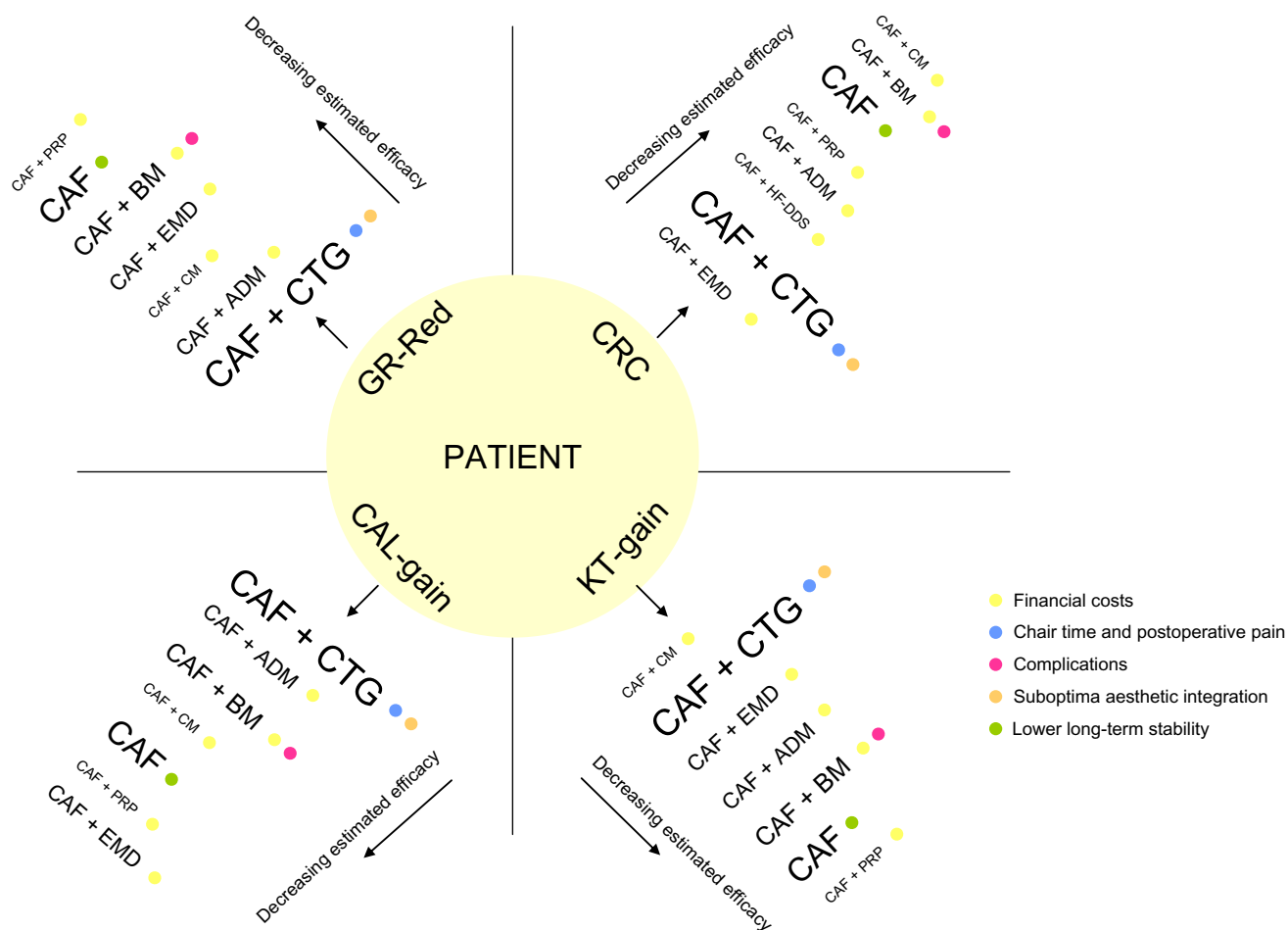


FIGURE 3. Based on data provided by Buti and colleagues:⁴³ Hierarchy of the candidate treatments, by outcome, according to the estimated efficacy.* ADM = acellular dermal matrix; BM = barrier membrane; CAF = coronally advanced flap; CAL gain = clinical attachment level gain; CM = xenogenic collagen matrix; CRC = complete root coverage; CTG = connective tissue graft; EMD = enamel matrix derivative; GR red = gingival recession reduction; KT-gain = keratinized tissue gain; PRP = platelet rich plasma. *The font size is proportional to the number of available randomized controlled trials focused on the technique; the legend shows, marked by color, the possible disadvantages of each technique, as reported in the literature.

field and without interference from the buccal marginal soft tissue, and to finish it at the right apico-coronal level. In addition, the subsequent surgical session is optimized by the possibility of having a proper crown emergence profile, which better supports ideal placement of the CAF or CTG.⁵⁰ According to Zucchelli and colleagues,⁵⁰ the decision whether to combine a restorative procedure with the periodontal surgical approach is guided by the relationship between the projected MRC and anatomical NCCL margins, as illustrated below.

In the case of an expected MRC that lies 1 mm or more above the coronal step of the NCCL, only a CAF is recommended, with the root concavity to be filled solely by the blood clot.

When the expected MRC lies at the level of the coronal step, a bilaminar technique (where a subepithelial CTG supports the CAF) is preferable (Figure 4).

If the expected MRC is apical to the coronal NCCL step, a combined perio-restorative treatment is



FIGURE 4. Multiple gingival recessions (Miller I, maxillary left lateral incisor and canine) associated with NCCLs. A, Initial examination: the expected MRC lies at the level of the coronal NCCL step; B and C, Bilaminar technique of root coverage: CAF with subepithelial CTG; D, Sutures; E, Clinical appearance 1 month after surgery.

suggested, where the composite restoration, finished at the MRC level, will support the subsequent CAF (Figure 5). If the expected MRC lies at the most apical extension of the NCCL, a composite restoration is recommended, with or without a small cosmetic correction provided by a CAF.

DEEP ROOT CARIES

Different is the case of deep carious cervical lesions (dCCLs), involving deep layers of dentin and/or affecting the root at a deeper apico-coronal level than the cervical area. In these cases, the anatomical landmark to be considered is the maximum apical extension of dCCL because it is necessary to achieve complete removal of the decayed tissue and cavity restoration.

Considering that a deeply placed restorative margin violating the dentogingival junction will produce loss of periodontal support⁵¹ and periodontal inflammation,⁵² the restoration of a dCCL must be preceded by, or be part of, a crown lengthening procedure in order to reestablish a proper *biological width*.⁵³

In general, as reported above, the presence of a GR associated with an NCCL/CCL on the root surface requires primarily a careful assessment of the lesion's characteristics and spatial relationships with the marginal periodontium to guide the choice of the most suitable surgical technique, with or without root restoration (Figure 6).

Nevertheless, it should be considered that some additional baseline site-specific patient characteristics may act as additional prognostic factors of the root coverage procedure, becoming relevant to the



FIGURE 5. Multiple gingival recessions (Miller I, maxillary right canine and bicuspids) associated with non-carious cervical lesions (NCCLs). A and B, Initial lateral and frontal view: the expected maximum root coverage (MRC) lies apical to the level of the coronal NCCL step, but coronal to the NCCL apical margin. C and D, Preoperative restoration at the expected MRC. E and F, Final result after the coronally advanced flap procedure (without additional connective tissue graft).

decision-making process on the most suitable mucogingival technique.

ADDITIONAL PROGNOSTIC FACTORS FOR ROOT COVERAGE

Subject-Related Variables

Some patient's behavioral characteristics, such as traumatic toothbrushing^{54,55} or smoking habit,^{56–59} seem to be potential limiting factors to achieving CRC^{56,57} or maintaining it over time.^{54,58} Those habits should be carefully identified, and every effort should be made by clinicians through proper instruction and motivation, to correct them in order to optimize results of periodontal plastic surgery procedures.

Defect Site Features

In addition to the two main parameters to be considered, that is the interproximal attachment level

(Miller) and the presence of a cervical wear of substance,^{7,10} some other site-specific clinical features deserve to be considered.

The baseline recession depth seems to significantly affect the possibility of CRC. Basically, the deeper the baseline recession defect, the smaller the likelihood of achieving CRC.^{42,60}

The position of the affected tooth/teeth in relation to the adjacent ones, such as buccal or lingual inclination or rotation, as well as dental crowding, might complicate the surgical procedure and postoperative maintenance of a proper oral hygiene. Dental extrusion may pose problems in the diagnostic phase, of predicting the achievable MRC. Also, dental morphotype (i.e incisor, cuspid, and bicuspid) could influence the outcomes of root coverage techniques, as various dental shapes show different degrees of root curvature and prominence, as well as size of the avascular area.⁶¹

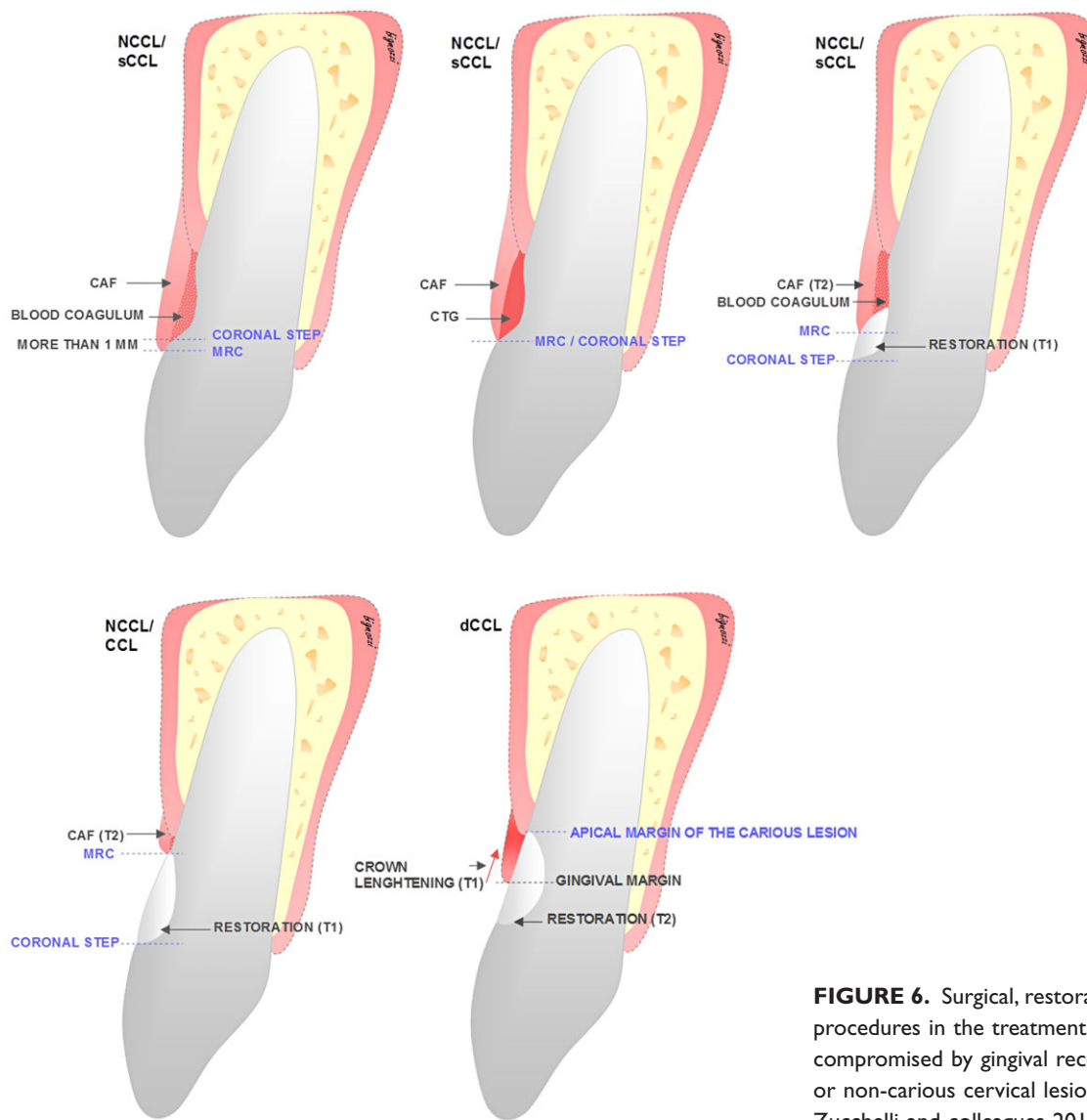


FIGURE 6. Surgical, restorative, and combined procedures in the treatment of root surfaces compromised by gingival recession and carious or non-carious cervical lesions (modified from Zucchelli and colleagues 2011).⁵⁰

Conflicting information is available regarding the impact of size and shape of interdental papillae adjacent to the recession site on the outcome of root coverage procedure. It has been reported that CRC had a slight positive correlation with papilla width⁶² and height,⁶³ although this latter finding is controversial,⁶⁴ as short papillae is often an expression of a thick and flat biotype,⁶⁵ which is unanimously considered as a positive prognostic factor in mucogingival surgical techniques.^{66,67}

The baseline amount of KT apical to the recession may affect recession reduction when using the CAF

technique alone,⁶⁸ although the literature is not unanimous.⁶⁹ As bilaminar techniques are considered able to provide higher likelihood of CRC⁷⁰ and greater long-term stability of the surgically repositioned gingival margin,⁷¹ KT deficiency may represent a possible indication for additional subpedicle graft.

Furthermore, isolated and deep GR with shallow vestibule depth and lack of KT apical to the defect may direct the choice toward some other techniques, such as DPF¹⁷ or an LAF,^{18–20,72} as these procedures use alternative KT donor sites

and are not affected by vestibule depth.⁷³ In the specific case of the lower anterior area, a partly epithelialized free gingival graft (PE-FGG) may be recommended, as this technique has been shown to promote root coverage, simultaneously increasing KT amount and fornix depth, as well as avoiding misalignment of the MGJ and limiting aesthetic concerns regarding tissue texture and chromatic integration.⁷⁴

CONCLUSIONS

Dental cervical wear of substance may complicate the treatment of GR lesions. A GR affecting an intact root may be treated with a root coverage technique chosen solely on the basis of the soft tissue characteristics, whereas a root affected by GR in combination with cervical carious or non-carious cervical lesion requests specific consideration of both hard and soft tissue lesions, regarding their clinical features and mutual spatial relationships.

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