Concise Clinical Review

Treatment of Gingival Recession: When and How?

Jean-Claude Imber \(^{a,b}\), Adrian Kasaj \(^a\)

\(^a\) Department of Periodontology and Operative Dentistry, University of Mainz, Mainz, Germany
\(^b\) Department of Periodontology, University of Bern, Bern, Switzerland

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ABSTRACT

Gingival recession is a common finding in daily clinical practice. Several issues may be associated with the apical shift of the gingival margin such as dentine hypersensitivity, root caries, non-carious cervical lesions (NCCLs), and compromised aesthetics. The first step in an effective management and prevention program is to identify susceptibility factors and modifiable conditions associated with gingival recession. Non-surgical treatment options for gingival recession defects include establishment of optimal plaque control, removal of overhanging subgingival restorations, behaviour change interventions, and use of desensitising agents. In cases where a surgical approach is indicated, coronally advanced flap and tunnelling procedures combined with a connective tissue graft are considered the most predictable treatment options for single and multiple recession defects. If there is a contraindication for harvesting a connective tissue graft from the palate or the patient wants to avoid a donor site surgery, adjunctive use of acellular dermal matrices, collagen matrices, and/or enamel matrix derivatives can be a valuable treatment alternative. For gingival recession defects associated with NCCLs a combined restorative-surgical approach can provide favourable clinical outcomes. If a patient refuses a surgical intervention or there are other contraindications for an invasive approach, gingival conditions should be maintained with preventive measures. This paper gives a concise review on when and how to treat gingival recession defects.

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Introduction

Gingival recession or soft tissue recession is defined as the displacement of the gingival margin apical to the cemento-enamel junction (CEJ) of a tooth or the platform of a dental implant.\(^1,2\) This condition is associated with the loss of periodontal tissues, including gingiva, periodontal ligament, root cementum, and bone at dental sites as well as the loss of mucosa and bone around dental implants. It has been suggested that the term ‘periodontal recession’ rather than ‘gingival recession’ would represent a more accurate definition of this condition at teeth.\(^2\) However, both terms are currently used synonymously.

It was demonstrated in several epidemiological studies that gingival recession is a common finding in daily clinical practice. The prevalence is ranging from 40% to 100% depending on both the population and the methods of analysis.\(^3-7\) Gingival recession defects can either be localised or generalised and can be located at labial, lingual and/or interproximal tooth surfaces.\(^8\)

The exposure of the root surface by gingival recession is frequently associated with dentine hypersensitivity, root caries, non-curious cervical lesions (NCCLs), compromised plaque control, and unaesthetic appearance.\(^9-11\) Moreover, untreated gingival recession has a tendency for further apical displacement over time in spite of good patient motivation.\(^12,13\) Nevertheless, not all patients with gingival recession are willing to undergo a surgical intervention to obtain soft tissue root coverage. Consequently, as clinicians we should select the right treatment approach considering patient- and tooth-related factors.

Therefore, the aim of this review is to provide a concise and up-to-date overview regarding how and when to treat gingival recession defects.

Classification and aetiology of gingival recession

For diagnosis and subsequent therapy, it is of importance to classify mucogingival conditions. According to the new
classification scheme of periodontal and peri-implant diseases, gingival recession belongs to the category ‘mucogingival deformities and conditions around teeth’. For many years and in most of the available clinical studies, gingival recession has been classified according to Miller. In general, this classification proved to be very useful but also revealed some limitations over time. Miller’s classification system depends on the mucogingival junction (MGJ), the presence or absence of keratinised tissue (KT), and the interdental bone/soft tissue loss. For example, a gingival recession not exceeding the MGJ but with interdental bone/soft tissue loss does not fit in any of the existing Miller classes. Moreover, the MGJ is not always identifiable and usually teeth exhibit, even if not clinically visible, a minimal amount of KT. Furthermore, the Miller classification takes the position of the gingival margin of two adjacent teeth into account, and if missing, making a proper diagnosis can be difficult. Thus, this classification system does not cover all possible variations of recession defects. To make a prognosis of a root coverage procedure, it is essential to classify a recession defect properly while considering patient-, site- and technique-related factors.

Recently, a novel treatment-oriented classification has been proposed, which is based on the assessment of the gingival phenotype, the severity of the recession, and the presence of associated cervical lesions. In a first step, the gingiva should be categorised into different phenotypes/bio-classes. In general, three different categories can be distinguished. Thin scalloped phenotypes show a higher gingival phenotype, the severity of the recession, and the presence of associated cervical lesions. A common way to distinguish between thick or thin tissue is to place a periodontal probe in the gingival sulcus and observe its transparency. If the probe is visible through the gingiva it is considered to be a thin phenotype, if not, it is usually a thick phenotype. For treatment, these clinical measurements are of significance since the probability to obtain complete root coverage (CRC) following surgical procedures will be reduced with the depth of the recession. Furthermore, in thin phenotypes (<1.1 mm) the results after root coverage procedures are less favourable. Another key factor for final root coverage is the integrity of the interdental attachment. Based on interdental clinical attachment level measurements, gingival recessions can be classified into three different types (Table 1).

After assessing the soft tissue, the condition of the tooth surface in the area of the gingival recession should also be evaluated. NCCLs are common findings in patients with gingival recession defects. Therefore, a classification for these defects has been introduced. A tooth with an identifiable CEJ belongs to class A, while one with no identifiable CEJ belongs to class B. Each class is subdivided depending on the presence (+) or absence (−) of a cervical step over 0.5 mm, yielding four classes (A+, A−, B+, B−).

Recently, a classification for peri-implant soft tissue dehiscence/deficiency (PSTD) was also proposed for single implants in the aesthetic zone. Based on the level of the soft tissue margin compared to the gingival margin of the homologous tooth and the bucco-lingual position of the implant head, four different classes of PSTD were introduced. All classes were further divided based on the height of the anatomical papilla into two (class I) or three (class II–IV) subclasses. There are several factors which can lead to mucosal recession on peri-implant sites such as lack of a certain amount of keratinised mucosa, immediately placed implants, buccal placement of the implant, and surgeon experience.

Before considering treatment of gingival recession defects, it is important to identify aetiological factors. At present, the true aetiology still remains unclear. Thus, gingival recession defects frequently have multifactorial causes. Plaque-induced periodontal inflammation and mechanical trauma caused by improper tooth brushing habits can be considered as the most important aetiological factors. Furthermore, the clinician should focus on susceptibility factors and modifiable conditions associated with gingival recession. The major susceptibility factors are thin gingival tissue, absence or a narrow band (<2 mm) of KT, probing depths extending beyond the MGJ and a positive history of progressive gingival recession and/or inflammatory periodontal disease. Modifiable conditions are plaque accumulation, inflammatory periodontal disease, aberrant frenum position, traumatic oral hygiene habits, subgingival restoration margins, smoking, and systemic conditions like diabetes. Therefore, the clinician should identify these factors and, if possible, modify them accordingly. In addition, an effective management and prevention program should help to improve patient awareness about gingival recession and to adopt adequate oral hygiene measures.

Non-surgical management of gingival recession

Gingival recession is related to several undesirable conditions. The most obvious is of aesthetic nature, but dental hypersensitivity, a reduced resistance against pathogenic stimuli such as cariogenic bacteria, and compromised plaque control are further important factors leading to patient discomfort. Although gingival augmentation is a well-studied, secure and efficient method resulting in pain relief and prevention of further progression, patients are not always willing to undergo invasive surgical treatment. If this is the case, a cascade of subsequent steps should be followed as a guideline.

First, as already mentioned above, the underlying aetiology of the recession defect should be identified. Thus, traumatic oral hygiene habits can be identified when associated
with NCCLs. These defects have a round-shaped ‘washed out’ look, whereas sharp, chipped defects are usually associated with bruxism and occlusal stress. Consequently, such clinical findings should lead to a focus on oral hygiene instruction and motivation. Furthermore, oral care products including toothpaste and toothbrush should be inspected. A soft or ultra-soft brush is less damaging to the soft tissues. Moreover, an electric toothbrush with a force-detector could act as a simple and educational tool for patients when applying heavy forces. In addition, toothpastes with a high abrasive factor (relative dental abrasity, RDA) should be exchanged for toothpastes with low RDA. A supportive oral hygiene regime can help to prevent further recession.

In contrast to patient-related factors, dental restorations (e.g. composite, ceramic, metal) may further influence gingival health. The position of a direct or indirect restorative margin can interfere with the supracrestal connective tissue attachment (biological width). Therefore, subgingival restoration margins may lead to inflammation, and as a result, gingival recession can develop. In addition, unpolished or overhanging surfaces tend to accumulate more plaque than smooth ones. Thus, careful preparation and finishing of restorations is essential to prevent the further development of gingival recession defects. If alveolar bone is lost due to periodontal disease, the gingival envelope or crevice moves in an apical direction. The vestibular bone lamella is very thin and can be resorbed in an

### Table 1 – Recession types

| Recession Type | Description |
|---------------|-------------|
| RT1           | Gingival recession with no loss of interproximal attachment. Interproximal CEJ is clinically not detectable at both mesial and distal aspects of the tooth. |
| RT2           | Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the interproximal sulcus/pocket) is less than or equal to the buccal attachment loss (measured from the buccal CEJ to the apical end of the buccal sulcus/pocket). |
| RT3           | Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the apical end of the sulcus/pocket) is greater than the buccal attachment loss (measured from the buccal CEJ to the apical end of the buccal sulcus/pocket). |

CEJ, cemento-enamel junction.
early stage of the disease, which could lead to smaller amounts of KT and/or attached tissue. Some studies have demonstrated that an insufficient band of KT along with missing attached gingiva is associated with poor plaque resistance and impaired access for oral hygiene. Nevertheless, the majority of evidence supports the view that gingival health can be maintained independent of its dimensions. Thus, gingiva with a narrow band of KT is considered to have the same ability to resist further attachment loss as gingiva with a wide zone of KT.

Dentinal hypersensitivity is another common finding in patients with gingival recession defects. Exposure of dentinal tubules results in hydrodynamic liquid flow that activates pain sensation. The hydrodynamic theory was proposed by Bränström and Aström and is the most rational theory to date. If a patient is suffering from dentinal hypersensitivity, the first step should include the use of a desensitisising toothpaste. Calcium sodium phosphosilicate, arginine and calcium carbonate, and strontium are ingredients that tend to occlude the dentinal tubules and prevent fluid movement. As a consequence, a decrease in activation of nociceptors will result. Moreover, other available desensitisers contain glutaraldehyde, which is a biological fixative leading to coagulation of plasma proteins and tubular blockage. Potassium nitrate is another desensitising agent with a different mode of action. This additive depolarises the nerve surrounding the odontoblast, thus reducing the action potential and therefore the dental nociception. Furthermore, a high fluoride application over time results in apposition of secondary dentin possibly leading to dentinal occlusion. It is proven that all these desensitisers require some time before the patient notices any pain relief. If interventions with different desensitisers do not achieve satisfactory pain relief, bonding agents can be carefully used to seal the dentinal tubules.

A different approach to treat dentinal hypersensitivity is based on laser therapy. Low intensity laser treatment aims to depolarise the cells in order to avoid exceeding the neurobiological threshold of the membrane’s potential. On the other hand, high intensity laser treatment occludes dentinal tubules. Based on clinical findings, lasers are showing results as good as other desensitisising strategies. Nevertheless, if these therapy options are not successful, the last step is endodontic treatment.

**Current surgical techniques for treating gingival recession**

The primary goal of any surgical approach for treating gingival recession defects will be CRC. Nevertheless, CRC is not always achievable and therefore, patients need to be informed about the chances to reach optimal clinical outcomes.

The most widely used techniques to treat gingival recession defects are the so-called pedicle flap surgical techniques (coronally advanced or rotational flaps). Norberg was the inventor of the coronally advanced flap (CAF) technique. Thereafter, the CAF was modified several times. Currently, for single recession defects, a flap with a trapezoid design is the treatment of choice. This surgical procedure includes two vertical releasing incisions and a split-full-split approach to overcome the problem with blood supply and the formation of scar tissue. Moreover, for multiple recession defects a modified CAF procedure was proposed by Zucchelli and De Sanctis. This technique requires no vertical releasing incisions, and therefore, a good blood supply of the flap will be maintained (Figures 1–5).

Other options for treating gingival recession defects are the so-called tunnel techniques. The tunnel can be prepared in
a full-thickness or split-thickness manner depending on the soft tissue dimensions. In most cases, the tissues are thin, and therefore, a full-thickness flap design is the safer approach to avoid perforations and ruptures. Good results can be obtained with the use of a modified coronally advanced tunnel (MCAT) technique in single and multiple gingival recession defects\(^{64-68}\) (Figures 6–10). More recently, the technique was modified by closing the tunnel laterally using simple sling or double sling sutures.\(^{69}\) This modification is mainly indicated in deep and narrow recession defects (Figures 11–15).

The CAF has also been proposed in combination with a sub-epithelial connective tissue graft (CTG). The indication to perform a CAF without a CTG is given if the KT height apical to the root exposure is more than 2 mm\(^{70}\) and the soft tissue thickness is more than 0.84 mm\(^{71}\). Furthermore, there are anatomical factors that influence the indication and the efficacy of a CAF without a CTG.\(^{72}\) It is not advisable to use a CAF without a CTG if interdental clinical attachment loss is diagnosed and/or only a minimal amount of KT apical to the gingival recession is present. A high frenulum insertion at the soft tissue margin or a very shallow vestibulum could be additional limitations. Furthermore, if the root is dislocated buccally or the root has a deep cervical defect, a CTG should be used in conjunction with the CAF.\(^{72}\) As arguments against harvesting palatal connective tissue, however, there may be limited availability, in addition to the prolonged surgical time involved and an associated increase in patient morbidity.\(^{73}\) Recently, a site-specific application of a CTG for the treatment of multiple gingival recession defects was proposed.\(^{74}\) Thus, only teeth with the aforementioned limitations in KT height and gingival thickness receive a CTG. This approach allows reducing the amount of soft tissue graft and donor site morbidity. The CTG can also be used in combination with tunnel techniques providing good clinical results in terms of CRC and mean root coverage.\(^{64,68,69,75,76}\) Two recent studies comparing the tunnel technique + CTG with CAF + CTG showed no significant differences in terms of CRC or mean root coverage.\(^{77,78}\) In contrast, Santamaria et al. showed significantly
superior clinical outcomes for CAF + CTG compared to tunnel technique + CTG in terms of CRC and mean root coverage, but more patients reported pain in the CAF group.⁷⁹

Overall, the use of a CTG provides more long-term gingival stability and better root coverage outcomes compared to treatment with a CAF alone.⁸⁰

In contrast to the CTG, free gingival grafts (FGG) are rarely recommended for root coverage procedures because of the low predictability and poor aesthetic outcome.⁸¹ The portion of a FGG placed on the denuded root surface does not have a good blood supply, and therefore, graft shrinkage or early necrosis may occur.⁷⁰ To overcome the low predictability of root coverage with FGG, a two-step procedure was introduced.⁸²–⁸⁴ In the first step, the FGG is used for gingival augmentation apical to the recession defect, followed by a CAF procedure to cover the root surface. More recently, this treatment approach was modified by minimising the
dimensions of the graft (same height of keratinisation as the
adjacent teeth) and by standardising the surgical proce-
dures.85 This technique is a possible treatment option in
cases with a high frenulum insertion and insufficient KT api-
cal to the recession defect. It is mainly used in the mandible
because of the aforementioned aesthetic issues.

To overcome the disadvantages associated with harvest-
ing the CTG from the palate, various biomaterials have been
proposed. Acellular dermal matrices (ACDM) from human
and porcine origin and collagen matrices (CM) of porcine ori-
gin are possible substitutes for the CTG. They act as scaffolds
for fibroblasts and endothelial cells to build up new connec-
tive tissue and promote epithelial cell migration from the bor-
ders of the adjacent tissue over the matrix.86,87 Furthermore,
collagen matrices can increase tissue thickness but are not as
effective at increasing KT width.88 Based on the available evi-
dence, ACDM may provide similar clinical outcomes to those
achieved by CTG in conjunction with a CAF.89–91 In a recently
published multicentre study,91 CM with CAF reduced the
patient recovery time, treatment time and decreased mor-
bidity compared to CAF with CTG. Nevertheless, the clin-
cal results in terms of root coverage and CRC were inferior
in the CM treated group. Similar findings were
demonstrated for MCAT+ CM versus MCAT + CTG.65 More-
over, a recent meta-analysis showed that a flap alone,
ACDM and CM were not effective in maintaining the sta-
bility of the gingival margin over time in comparison to
CTG procedures.92

Other treatment modalities including the use of non-
resorbable and resorbable membranes (Guided Tissue Regen-
eration) have been proposed for treating gingival recession
defects.84 However, considering the high incidence of compli-
cations (e.g. membrane exposure, wound dehiscence), the
routine use of this technique cannot be recommended at
present.70,93,94

The use of enamel matrix derivative (EMD) in conjunction
with root coverage procedures is a further treatment option.
CAF in conjunction with EMD provides more favourable clin-
cal results in terms of CRC, gain of KT, and recession reduc-
tion when compared to CAF alone.86,95 There is a lack of
evidence to support the use of EMD in conjunction with
tunnelling procedures.64,96

Since NCCLs are a common finding in conjunction with
gingival recession,23 various treatment options have been
proposed. Based on the type of recession and the associated
tooth defect, Zucchelli et al.97 suggested a combined restor-
ative and surgical approach for treating recession defects
associated with NCCLs. The treatments included CAF with or
without CTG in combination with complete98−101 or
partial71,97,102,103 defect restoration of the NCCLs. After 1 year,
the combined approaches resulted in high patient satisfac-
tion and an optimal aesthetic outcome.

Santamaria et al.98−101 demonstrated comparable clinical
outcomes when gingival recession defects associated with
NCCLs were treated by a CAF alone or CAF + CTG, irrespective
of whether the NCCLs were restored or not. Recently, a partial
restoration of class B+ cervical defects with the apical border
of the restoration placed 1 mm beyond the CEJ estimation
was proposed.103 To reconstruct the missing CEJ, interdental
papilla104 and CEJ levels at contralateral teeth102 have been
used as reference points for the partial defect restoration.
The treatment with CAF + CTG showed comparable clinical
outcomes between partially restored and non-restored cervi-
cal lesions.97,102,105 However, the use of partial restoration
resulted in greater reduction of dentin hypersensitivity and a
better gingival margin contour.\textsuperscript{24} Cairo et al.\textsuperscript{71} suggested that adding a CTG under a CAF in the treatment of gingival recession with a previously restored CEJ should only be considered in a thin gingival phenotype (≤0.84 mm).

When it comes to peri-implant soft tissue dehiscence/deficiencies, different treatment protocols, depending on the position of the implant-supported crown, bucco-lingual position of the implant head, and height of the anatomical papillae, were proposed.\textsuperscript{24} If a surgical intervention is applied, a CAF in conjunction with a CTG is the most studied treatment option in such cases.

Prior to a possible surgical intervention, the quality and quantity of the interproximal soft tissues, the papillae heights, and the position of the crown and/or implant could lead to removal of the implant-supported crown. Therefore, special abutments can be used for maturation and increase of the interproximal soft tissues.

Conclusions

When developing a treatment strategy, clinicians should first focus on susceptibility factors and modifiable conditions while increasing the patient’s awareness about gingival recession. In cases where a surgical approach is indicated, CAF and tunnelling procedures combined with a CTG are considered the most predictable treatment options for single and multiple recession defects. If there is a contraindication for harvesting a CTG from the palate or the patient wants to avoid a donor site surgery, adjunctive use of ACDM, CM and/or EMD can be a valuable treatment alternative. For gingival recession defects associated with NCCLs a combined restorative-surgical approach can provide favourable clinical outcomes. If a patient refuses surgical intervention or there are other contraindications for an invasive approach, gingival conditions should be maintained with preventive measures.

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