

Gingival recession is defined as the location of the gingival margin apical to the cementoenamel junction (CEJ). The treatment of gingival recession is an ever more frequent query of patients with high standards of oral hygiene. The ultimate goal of any root coverage procedure is the location of the gingival margin coronal to the CEJ (complete root coverage), with minimal probing depth and a pleasant soft tissue integration with the adjacent teeth. A recent systematic review showed that a coronally advanced flap is a safe and predictable approach for root coverage, and it is often associated with the complete coverage of the exposed root surface. A connective tissue graft or enamel matrix proteins, in conjunction with a coronally advanced flap, enhances the probability of obtaining complete root coverage and improving recession reduction in Miller Class I or II single gingival recessions.

The successful outcome of a root coverage procedure is based on a stable gingival margin coronal to the CEJ after healing. The CEJ is the major reference point used to establish a

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**A Technique to Identify and Reconstruct the Cementoenamel Junction Level Using Combined Periodontal and Restorative Treatment of Gingival Recession. A Prospective Clinical Study**

Gingival recession is often associated with abrasion in the cervical area with an unidentifiable cementoenamel junction (CEJ). This condition complicates the diagnosis and treatment of gingival recession. The aim of this study was to propose a technique to identify the CEJ level for planning periodontal and restorative treatment of the recession. The CEJ of a contralateral homologous tooth or adjacent teeth was used to replicate the lost CEJ at the treated tooth. Reconstruction of the CEJ using composite resin and a coronally advanced flap, with or without a connective tissue graft, was performed for 25 recessions in 12 patients. After 2 years, 20 defects (80%) showed complete root coverage with a significant recession reduction (2.4 mm, P < .0001). (Int J Periodontics Restorative Dent 2010;30:573–581.)

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correct diagnosis and to plan the proper treatment of a gingival recession. However, gingival recession is often associated with tooth abrasion in the cervical area, leading to a total or partial disappearance of the CEJ, and sometimes to a deep enamel/root discrepancy.5 If the CEJ is not identifiable, it is difficult to assess the true depth of the real gingival recession, and therefore, the diagnosis is not accurate. Other problems may arise during surgery; in fact, an unidentifiable CEJ does not allow for the precise location of the gingival margin of a flap during suturing. In addition, a deep enamel/root discrepancy resulting from severe tooth abrasion shows sharp edges often associated with dental hypersensitivity. The presence of such defects may complicate the proper adaptation of the flap on the tooth, leading to soft tissue collapse and poor stabilization of the graft over the exposed root. The absence of an identifiable CEJ does not allow for an accurate assessment of the clinical outcomes following root coverage procedures, and therefore it is impossible to establish if complete root coverage really has been achieved. In this case, even if complete root coverage occurs, the final esthetic result may be poor because the profile of the gingival margin tends to be flat, parallel to the abrasion edge.4 Finally, the loss of an identifiable CEJ makes the interview with the patient regarding the choice of treatment and its prognosis difficult. The patient might expect that the entire dental lesion (root and crown abrasion) will be covered completely by gingival tissue after the procedure. Since the original gingival margin covered the CEJ, the margin level after the procedure cannot be located coronally on the lost enamel but apically at the level of the previous CEJ; the periodontist has to explain to the patient the expected location of the gingival margin after treatment.

Restoration of a missing CEJ before the root coverage procedure has been suggested.6 Various dental materials and surgical approaches have been used to manage gingival recessions associated with tooth abrasion in the area of the CEJ.7,8 The aim of this clinical study was to propose a technique for the identification and reconstruction of the CEJ using combined periodontal and restorative treatment of a gingival recession.

Method and materials

Study population

A total of 12 patients with esthetic requests or dental hypersensitivity were selected consecutively from a private periodontal practice and enrolled in this study. All patients were older than 18 years of age and with no systemic disease. Periodontal entry criteria were: the presence of single or multiple Miller Class I or II recession defects, a partially or totally unidentifiable CEJ in the recession area, the absence of periodontal disease, full-mouth plaque and bleeding scores < 10% (four sites), and the presence of a contralateral homologous tooth or adjacent teeth. Periodontal exclusion criteria included the presence of tooth rotation, extrusion, or significant occlusal abrasion at the involved teeth.

Before any procedure, each participant signed an informed consent form in accordance with the Helsinki Declaration of 1975, as revisited in 2000. Professional oral hygiene procedures were performed for each patient. All patients received oral hygiene instructions (roll technique) to eliminate the habits related to the etiology of the recession/tooth abrasion at least 3 months prior to surgery.

Identification of CEJ level

A contralateral homologous tooth or adjacent teeth were used to identify the level of lost CEJ, the crown length, and the shape of the gingival margin at each tooth with gingival recession.

Contralateral homologous tooth with gingival recession and a completely identifiable CEJ

When using the contralateral homologous tooth with gingival recession, two PCP UNC-15 periodontal probes (Hu-Friedy) were used to identify the reference points. The first periodontal probe was positioned horizontally over the CEJ at the base of the interdental papillae, and the second periodontal probe was positioned vertically, parallel to the tooth axis at the center of the tooth (Fig 1). By crossing the two probes, the following points were identified: the most mesial coronal point of the interproximal CEJ (A), the most distal coronal point of the interproximal
CEJ (B), the intersection point between the CEJ and the vertical probe at the center of the tooth (C), and the incisal margin at center of the tooth (IM).

After identification of the reference points, the following measurements were assessed: the incisal margin to the CEJ at the center of the tooth (length of the anatomical crown; IM–C) and the mesiodistal width of the anatomical crown at the base of interdental papillae (A–B).

Once the reference points and measurements were obtained, these were transferred to the involved tooth. The vertical probe was positioned at the center of the tooth, and the distance IM–C served to identify the most apical point of the lost CEJ. The horizontal probe was positioned at the base of the interdental papillae, identifying points A and B. The reference points (A, B, C) were connected, simulating a scalloped line similar to that of the contralateral homologous tooth.

**Homologous tooth without gingival recession**

In patients with a homologous tooth without gingival recession, since the CEJ was covered by the gingival margin, the length of the anatomical crown was obtained by placing the vertical probe at the center of the tooth and adding the corresponding probing depth (PD), thus identifying the point C_{PD} (IM–C + PD). Therefore, the distance IM–C_{PD} showed the location of the most apical point of the CEJ. The horizontal probe identified points A and B, as referenced previously (Fig 2).
Adjacent tooth/teeth with an unidentifiable CEJ at a contralateral homologous tooth
If the CEJ of the contralateral homologous tooth was not identifiable, the levels of the CEJ of the adjacent tooth or teeth were used as reference. If recession was evident at the adjacent tooth, the identification of points A and B and the corresponding distance was similar to that using a contralateral homologous tooth with an identifiable CEJ. The position of the vertical probe to identify point C was also similar, even if the final location of the most apical point of the CEJ (point C) was different. Since the length of the anatomical crown and periodontal biotype are different, the location of point C varies accordingly. If treatment is received at a first premolar (Fig 3), the reference is the adjacent canine, and therefore the obtained vertical length must be reduced.

If the adjacent tooth or teeth were without recession, the identification of the CEJ was assessed in the same manner as that of a homologous tooth without gingival recession.

CEJ reconstruction
Following the positioning of rubber dam, the reconstruction of the CEJ profile or lost enamel was performed before the surgical procedure. In patients with an unidentifiable CEJ resulting from superficial abrasion without surface discrepancy, following the identification of reference points, the CEJ profile was restored with a composite resin dental material (Enamel Plus HFO, Micerium), thus creating a smooth surface. In patients with a deep abrasion (steep) involving the root and crown, the lost enamel and CEJ were restored, paying close attention to creating a smooth finishing line between the dental material and root and avoiding filling the root abrasion with composite resin. The residual root defect then underwent periodontal treatment (flap with or without graft).

Measurements at the involved tooth
After completion of the restorative procedures, the following dental and periodontal measurements were assessed before the surgical procedure (Fig 4): the distance between the incisal margin and gingival margin (IM–GM₀), the distance between the most apical point of the reconstructed CEJ and the gingival margin (CEJₐ–GM₀) corresponding to the baseline gingival recession (REC₀), the distance between the most apical point of the reconstructed CEJ and the incisal margin (CEJₐ–IM), probing depth (PD), and the presence of bleeding on probing.
Surgical procedures

With the aid of a surgical microscope or operative loops in patients with single or multiple recessions, a coronally advanced flap, with or without a connective tissue graft, was performed.\textsuperscript{12–14} Split full-thickness flaps were raised to the mucogingival junction with or without the use of vertical releasing incisions. The flaps were mobilized with a sharp horizontal incision in the vestibular mucosa to eliminate muscle tension and obtain adequate coronal displacement of the gingival margin. If necessary, additional finishing of the restoration margin was then accomplished using a diamond bur and rubber cup. The exposed root surface apical to the restoration was treated carefully with root planing. When a smooth root surface was obtained underneath the restored CEJ, a coronally advanced flap alone was performed. If a root discrepancy resituated apical to the restoration, this was filled using a connective tissue graft harvested from the palate and secured in the area of the bony dehiscence by means of resorbable sutures. The coronal level of the graft ended at the apical level of the reconstruction. The anatomical interdental papillae were then carefully deepithelialized and the flap was sutured coronally using sling or interrupted sutures, thus covering the apical limit of the restoration.

Postsurgical protocol

Patients were instructed to avoid any mechanical trauma at the surgical area and to avoid brushing their teeth. A chlorhexidine rinse was prescribed twice daily for 1 minute. Ten days after surgery, sutures were removed and prophylaxis with polishing was performed. Approximately 3 weeks after surgery, patients were instructed to perform a mechanical tooth cleaning with a toothbrush. Patients were recalled 3, 6, 9, and 12 months after surgery for professional oral hygiene procedures until the 1-year follow-up. Patients were also recalled 18 months and 2 years after surgery for follow-up.

Final measurements at the 2-year follow-up

At the final follow-up (2 years postsurgery), the distance between the incisal margin and the new gingival margin (IM–GM\textsubscript{1}) was assessed. The amount of root coverage was evaluated by the difference between the original gingival margin position and the new one (IM–GM\textsubscript{0} – IM–GM\textsubscript{1}), which corresponded to the recession reduction (Rec Red). When Rec Red was equal to or greater than CEJ–GM\textsubscript{0}, complete root coverage was determined. If Rec Red was less than CEJ–GM\textsubscript{0}, the amount of residual recession (Rec\textsubscript{r}) was assessed. In addition, PD, bleeding on probing, complications, and patient discomfort were also registered in the patients’ clinical charts.

Statistical analysis

Statistical analysis was performed using JMP (version 7.0, SAS Institute) and MLwiN (version 2.02; CMM, University of Bristol) software. Descriptive statistics were presented as mean ± standard deviation for quantitative variables. Since some patients presented more than one treated site, analyses were performed on three levels: (1) patient, (2) tooth, and (3) observation. Models were adjusted considering baseline recession depth (Rec\textsubscript{0}). The outcome variable of the models was Rec Red at the 2-year follow-up examination.

Results

According to the protocol, 12 patients (8 women, 4 men) with a total of 25 gingival recessions were treated by the same operator (FC). The mean age was 42.6 ± 10.7 years. The mean PD at baseline was 1.2 ± 0.4 mm. Considering the CEJ position at the involved teeth, the mean baseline recession (Rec\textsubscript{0}) was 2.6 ± 1.3 mm. Nine of 12 patients showed multiple gingival recessions, while the residual 3 patients were treated for single gingival recessions.

Before the surgical procedure, the lost enamel or CEJ area was restored by means of a composite resin dental material. Of the nine patients showing multiple gingival recessions, four were treated by means of a coronally advanced flap with a connective tissue graft and five with a coronally advanced flap alone. Of the three patients showing single recessions,
two were treated with a coronally advanced flap alone, while one was treated with a coronally advanced flap and a connective tissue graft.

Descriptive statistics of the treated patients are presented in Table 1.

The amount of root coverage was evaluated by the difference between the original and final gingival margin levels (IM–GM₀–IM–GM₁) and corresponded to the recession reduction (Rec Red). When Rec Red was equal to or greater than CEJ₀–GM₀, complete root coverage was determined. When Rec Red was less than CEJ₀–GM₀, the amount of residual recession (Rec₁) was assessed. At the 2-year follow-up, the final residual recession (Rec₁) was 0.2 ± 0.5 mm (91% mean root coverage). The corresponding mean Rec Red was 2.4 ± 1.5 mm (P < .0001).

Twenty defects (80%) showed complete root coverage. No major complication was observed and no residual dental hypersensitivity was reported. All treated sites showed PD ≤ 3 mm (mean PD, 1.5 ± 0.6 mm), with no bleeding on probing. All restorations were retained at the last follow-up and no marginal discrepancy was detected at the clinical examination. All patients were satisfied with their treatment.

Clinical parameters from the baseline and 2-year follow-up examination are reported in Table 2. Figures 5 and 6 show the complete restorations of two patients (patients 1 and 4).
Fig 5 Patient 1.

Fig 5a (left) Gingival recessions were evident at the maxillary right first premolar, canine, and lateral incisor with abrasion in the area of the CEJ. Note the planned CEJ level at the canine (dotted line).

Fig 5b (right) Flap elevation was completed for multiple recessions after enamel/CEJ restoration.

Fig 5c (left) The flap was sutured coronally to the restored CEJ level.

Fig 5d (right) Complete root coverage was achieved by the 2-year follow-up.

Fig 6 Patient 4.

Fig 6a (left) Deep abrasion and gingival recession was seen at the mandibular left first premolar.

Fig 6b (right) CEJ reconstruction was accomplished before flap elevation (arrow).

Fig 6c Flap elevation.

Fig 6d (above) A connective tissue graft was placed beyond the apical limit of the restoration (arrow).

Fig 6e (right) Complete root coverage was noted at the 2-year follow-up.
Discussion

The CEJ serves as the reference point for the definition, diagnosis, and treatment of gingival recessions. However, gingival recessions are often associated with tooth abrasion in the cervical area with a total or partial disappearance of the CEJ, sometimes with deep enamel/root discrepancies. The absence of the CEJ associated with dental surface discrepancies determines several problems during preoperative diagnosis, soft tissue management, the final assessment of the outcomes. The absence of an identifiable CEJ and the presence of enamel abrasion might create misleading treatment expectations, since patients may expect that the entire dental lesion will be covered completely by soft tissue following therapy. In patients with partial or total CEJ abrasions, the use of homologous or adjacent teeth is of paramount importance to make the patient aware of the limit of the root coverage procedure. Patients should be alerted that a successful outcome is the final location of the gingival margin at the same CEJ level as the corresponding tooth; an enamel lesion, if any, cannot be covered by the gingival tissue.

In the periodontal literature, different approaches have been proposed to manage deep hard tissue discrepancies. Grinding the abrasion to eliminate the sharp edges was suggested to improve flap/graft position and stabilization. However, if root coverage is incomplete, this procedure can lead to increased postsurgical hypersensitivity and should be considered critically if patients do not complain of dental hypersensitivity before treatment. The use of a bilaminar technique to improve soft tissue adaptation for an enamel/root discrepancy has been suggested in the past couple of years, even if this procedure could result in a flat gingival margin parallel to the abrasion edge.

In light of these considerations, the identification and reconstruction of the CEJ level and lost enamel is decisive to manage the gingival recession associated with CEJ abrasion. In this study, 25 recessions associated with dental abrasions were treated in 12 patients using the described technique. All treated patients showed homologous or adjacent teeth with identifiable CEJ. By intersecting two periodontal probes, detected reference points and measurements were reported at the treated tooth, allowing for the identification of lost enamel, the root surface, and the CEJ level in the area of abrasion. This technique allowed both clinicians and patients to identify the correct line of root coverage. This method is also useful to identify the CEJ level of a given tooth when the contralateral/adjacent teeth do not show a recession. In fact, when the CEJ is covered by the gingival margin, the length of the anatomical crown of the reference tooth is measured by adding the length of the clinical crown to the corresponding probing depth.

All restorations were retained at the last follow-up, and no marginal discrepancy was detected at the clinical examination. All treated sites showed no presence of bleeding on probing at the last follow-up, even if the apical limit of the restoration was covered by the gingival margin. The combined restorative and periodontal approach allowed for careful finishing of the restoration margin after flap elevation using a magnification system. This may have facilitated proper soft tissue healing over the apical aspect to the restoration margin. These findings corroborate the observation that minimal inflammation is observed following root coverage and CEJ reconstruction when a proper finishing of the dental material is accomplished.

In this study, two different surgical procedures were used. A coronally advanced flap was used for smooth root surfaces apical to the restored CEJ. A coronally advanced flap with a connective tissue graft was used for a deep root abrasion apical to the restored CEJ to minimize a possible soft tissue collapse into the root abrasion. These results support studies showing that root coverage is feasible irrespective of the type of dental material used for the restoration or the type of surgical approach applied.

All treated defects showed PD ≤ 3 mm at the last follow-up, thus supporting a previous investigation reporting no detrimental effects for deep periodontal tissue using resin restorations in conjunction with flap surgery. In addition, epithelial/connective tissue attachment to resin material may also be observed after restorative procedures of subgingival lesions.
Conclusion

This technique is useful in identifying the level of lost CEJ at teeth with gingival recessions associated with tooth abrasion. Clinical outcomes obtained with combined restorative/periodontal treatment may be maintained at the 2-year follow-up, with good esthetic results and minimal signs of inflammation.

References
