A Two-Step Surgical Approach with Flattening of the Root Surface to Treat Localized Gingival Recessions Affecting Mandibular Incisors: A Case Series Report

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Root coverage in the anterior mandible is challenging due to a thin gingiva, shallow vestibule, and/or high frenulum. This case series reports on the flattening of the root surface to create a new emergence profile conceived with a two-step surgical approach aimed at providing more space for the graft, increasing the thickness of the gingival margin, and getting extra soft tissue in the open area of the recession. A total of 10 patients with recessions affecting the mandibular incisors were treated to evaluate this two-step approach, which included odontoplasty of the root followed by a connective tissue graft. At 1 year, the mean coverage was 100% in Class II recessions, and 80.5% in Class III. The mean keratinized tissue increase was 5.80 ± 1.75 mm. This surgical approach could be proposed as an alternative when treating mandibular anterior teeth with root prominence or with a buccally tilted position. Int J Periodontics Restorative Dent 2018;38:683–690. doi: 10.11607/prd.3566

Localised gingival recession (LGR) is defined as the apical displacement of the gingival margin from the cemento-enamel junction (CEJ) with oral exposure of the root surface occurring on the tooth labial surface. Different surgical procedures and flap designs have been proposed for the treatment of LGR. The results from systematic reviews have demonstrated that the use of subepithelial connective tissue grafts (SCTGs) could be considered the gold standard for achieving root coverage. However, the predictability of this procedure is influenced by a variety of patient, defect, and surgical factors, such as smoking, extent of the lesion, flap tension, and tooth site, with mandibular incisors being less predictable than other tooth sites for root coverage. The lower success rate in these teeth has been associated with factors related to the anatomy of the area: flat vestibule, lack of keratinized gingiva, thin periodontal biotype, cervical insertion of a frenulum, lip muscles, root prominence, and tooth crowding. One of the key risk factors of LGR in this area is the frequent labial inclination of the anterior teeth leading to root prominence and buccal alveolar bone dehiscence, which is a common occurrence after orthodontic therapy and which, when combined with inadequate plaque control and/or traumatic mechanical factors, often leads to LGR.
The treatment of these lesions traditionally has been based on the use of gingival autografts harvested from the palate, aiming for full coverage of the exposed root surface. The use of free gingival graft (FGG), although frequent in the past, often leads to unesthetic outcomes and postoperative morbidity due to the extensive donor tissue harvesting. Modern mucogingival techniques are based on a combination of coronally advancing flaps and connective tissue graft (CAF + CTG), but this surgical approach usually results in shallowing of the vestibule due to the strong tension on the mucosa from the mentalis muscle. Allen and Zabalagui et al proposed the use of CTGs in combination with split-thickness tunneling, placing the graft without its coronal advancement. In this technique, however, the flap does not cover a portion of the graft and the vascular supply may be compromised, especially in situations with root prominence and a shallow vestibule. Many of the complications of mucogingival surgical techniques currently used in the anterior mandibular area occur due to the presence of prominent roots and lack of space for adequate healing of the autologous CTG. It is therefore the objective of this two-step treatment approach to first correct the root prominence by flattening the root and, once a new emergence profile is attained, perform the root coverage procedure by means of a tunnel submarginal flap combined with a CTG. The aim of this case series study was to analyze the clinical outcome of the two-step procedure in patients with localized gingival recessions and prominent roots secondary to orthodontic therapy.

Materials and Methods

A total of 10 patients (3 men and 7 women, aged 28 ± 10 years) affected by gingival recession on the mandibular incisors were included in this case series. The patients were selected among individuals referred to a private periodontal practice (J.N., Valladolid, Spain) between September 2014 and September 2016. The patients completed a questionnaire and provided signed informed consent. All the participants met the following inclusion criteria: adult patients (aged ≥ 18 years), systemically healthy and presenting at least one recession affecting one of the mandibular incisors after orthodontic treatment, combined with lack of keratinized tissue apical to the recession and a shallow vestibule. Subjects were excluded if they smoked more than 10 cigarettes per day or were systemically unhealthy (diabetes, drug intake causing gingival enlargement, or any contraindication for periodontal surgery). Recession defects associated with caries and/or deep noncarious cervical lesions were also excluded. Once selected, the patients were informed of the aims of the therapy, the nature of the surgical procedure, and the importance of compliance with oral hygiene practices and with attending the recalls. Once they agreed, the subjects signed a consent form and were included in this pilot study. Prior to the surgical procedure, a prophylaxis session was carried out that included instructions in proper oral hygiene.

Treatment Concept

The first step was modification of the root surface to eliminate the root prominence, creating a new emergence profile aimed at providing more space for the graft, increasing the thickness of the gingival margin, and getting extra soft tissue into the open area of the recession. The prominent root was flattened with a diamond bur under profuse water cooling. In Miller Class III LGR, the maximum level of root coverage (MRCL) was calculated by transferring the distance between the existing CEJ and the contact point from the tip of the papillae (Fig 1) according to the protocol reported by Zucchelli et al. In cases of coronal insertion of an aberrant frenulum, frenectomy was performed at the same time as the odontoplasty, with a diode laser (iLase, Biolase Technology) at a wavelength of 940 ± 15 nm. To control possible dentin hypersensitivity, topical fluoride was applied by the patient (sodium fluoride 2.72% or fluoride ion 1.23%, Dentaflex) twice a day for 2 minutes over 15 days.

At 8 weeks after the odontoplasty, the root coverage surgical procedure was performed. Prior to surgery, patients rinsed with a 0.12% chlorhexidine gluconate mouthrinse (Perio-Aid, Dentaia) for 1 minute. Following local anesthesia, a buccal supraperiosteal submarginal tunneling incision was performed using a 15C blade (Swann-Morton) and tunneling...
instruments (Hu-Friedy) according to the technique described by Allen. Additionally, the most coronal fibers of the mentalis muscle were dissected. The CTG was harvested from the hard palate in the region between the maxillary first premolar and the second molar following the technique described by Zucchelli et al., in which an epithelialized FGG was harvested and then the graft was carefully de-epithelialized. Care was taken not to remove the periosteum protecting the underlying bone, and the borders of the palatal wound were immediately sutured and a periodontal dressing applied (Coe-Pak, GC). The CTG was introduced into the tunnel from the marginal aspect of the recession using horizontal mattress sutures according to the technique described by Zabalegui et al. Once the CTG was introduced in its complete length, its coronal portion was secured to the incisor by means of a sling suture (Fig 2a). To complete the procedure, the sulcular margins were adapted and secured with interrupted sutures without advancing the flap coronally (Fig 2b). Monosy 6-0 (B. Braun) absorbable monofilament sutures were used. All surgical procedures were performed by the same experienced periodontist (J.N.).

Patients received strict postoperative instructions, including pain medication (ibuprofen 600 mg 1 hour before the surgical procedure and then every 12 hours until there was no pain or inflammation). Patients were instructed not to pull the lower lip, to eat a soft diet the first several days postsurgery, and to refrain from physical exercise for 2 weeks, until suture removal. They were also instructed not to brush their teeth in the treated area but to rinse with chlorhexidine solution (0.12%) twice a day for 1 minute. Sutures at the donor site were removed 7 days postoperative, and sutures in the grafted site were removed 2 weeks postoperative. Once sutures were removed and the area was carefully polished, patients were again reinstructed in mechanical plaque control of the treated area and were maintained on chlorhexidine rinse for 2 additional weeks. Patients were recalled for supragingival polishing at 4 weeks, 2 months, 3 months, 6 months, and the final examination (1 year) (Fig 2c).

Clinical, Esthetic, and Patient-Reported Outcomes

The following clinical measurements were taken at baseline and at the 1-year follow-up visit. All clinical measurements were recorded using a periodontal probe (PCP-UNC 15, Hu-Friedy) and rounded up to the nearest millimeter at the midbuccal aspect of the treated teeth.

- Percentage of root coverage calculated as (recession at baseline – recession at the final examination) / recession at baseline) × 100
- Complete root coverage (CRC), when no root surface was visibly detected at the 1-year clinical examination (MRCL was evaluated at Class III gingival recessions)
- Gingival recession (GR), from CEJ to the gingival margin (GM)
- Probing depth (PD), from the GM to the bottom of the pocket
- Clinical attachment level (CAL), from the CEJ to the GM
- Keratinized tissue width (KTW), from the GM to the mucogingival junction (MGJ)
Bone dehiscence (BD), from the CEJ to the apical extension of the root exposure

- Evaluation of the esthetic outcomes 1 year after root coverage by means of the root coverage esthetic score (RES), evaluating the position of the GM, the marginal tissue contour, the soft tissue texture, the position of the MGJ, and the gingival color

- Dentin hypersensitivity by means of a visual analog scale from 0 to 10 after the application of a thermal stimulus (water jet at 20°C)

These measurements were recorded after the odontoplasty procedure, immediately before the surgical procedure (8 weeks after odontoplasty), and 1 and 8 weeks after the surgical procedure.

Data Analysis

Variables reporting quantitative outcomes were expressed as mean ± SD. Variables reporting categoric outcomes were expressed by frequency distributions. Shapiro-Wilk test was used to evaluate the normality of the data distribution. When data followed normal distribution, paired Student t test was used to evaluate differences between baseline and 1-year follow-up regarding PD, RD, CAL, and KTW. If the variable was not normally distributed, Wilcoxon rank sum test for paired samples was used. To study correlations between quantitative variables, intraclass correlation coefficients were used. Statistical analysis was performed using a statistical software program (SPSS Version 20.0, IBM). In all tests, P < .05 was considered statistically significant.

Results

Healing was uneventful in all patients. At 1 week, only one patient had experienced superficial sloughing at a portion of the CTG. At 4 weeks, all the grafts were completely incorporated and re-epithelization was complete (Fig 3).

Table 1 presents the changes in clinical parameters between baseline and 1 year postoperatively for each of the patients treated. Table 2 shows the data on root coverage. The mean percentage of root coverage was 86.35% for all treated recessions (80.50% for Class III recessions). CRC was achieved in all Class I and II gingival recessions, and in 28.5% (2 of 7) of Class III recessions, but root coverage was considered complete when MRCL was achieved at 100% (Table 2).
At 1 year (Fig 4), there was a statistically significant CAL gain of 4.65 ± 1.91 compared to baseline. Similarly, there was a statistically significant reduction in GR from 5.25 ± 2.63 mm to 1.0 ± 1.24 mm at 1 year. The mean gain in KTW was also statistically significant, at 5.80 ± 1.75 mm (Table 2).

The esthetic evaluation at 1 year showed a mean RES of 8.20 ± 1.54. The main reason for this score was because the mean percentage of root coverage for Class III recessions was 80.5% and 6 of 10 patients failed to achieve an MGJ aligned with the MGJ on adjacent teeth; usually it was more apically positioned.

The results from the patient-reported outcome measures (PROMs) on dentin hypersensitivity showed scores increased after odontoplasty by 2 points (mean baseline score 5.22 ± 2.99 increased to 7.0 ± 2.39 after odontoplasty). However, after surgery, sensitivity decreased 3 points (mean postsurgical score 4.87 ± 2.0), and 2 months after root coverage, PROMs showed lower scores than baseline (mean final score 0.88 ± 1.53), similar to untreated teeth.

Discussion

The results achieved with this two-step approach to treat mandibular anterior LGRs in prominent teeth after orthodontic therapy with the combination of odontoplasty to modify the root surface, followed later by the root coverage procedure using a CTG with a tunnel technique, showed statistically significant improvements, with a mean RC of 86.3%. CRC was achieved in all Class I and II LGRs and in 80.5% of Class III LGRs. Furthermore, there was a significant increase in keratinized tissue with maintenance of the vestibular depth and good esthetic results.

The lesser percentage of CRC in Class III LGRs was due to the large dehiscence defects present in these sites (mean 7.95 mm). In fact, there was a statistically significant correlation between the osseous depth of the dehiscence and the residual gingival recession after treatment (.795; \( P \leq .05 \)). Similar outcomes were reported by Berlucchi et al., who showed that the higher the distance between the CEJ and the bone crest, the harder it was to achieve...
However, when the MRCL was considered for the Class III gingival recessions, MRCL was achieved in all of the lesions.

Similar outcomes were reported by Nart et al, with CRC in 42.85% of the sites (3 of 7), when CAF + SCTG was used to treat Class III gingival recessions in mandibular incisors. Also in Class III LGRs, Aroca et al reported CRC in 38% (8 of 20) of the cases treated by SCTG with the modified tunnel approach combined with enamel matrix proteins, although the recession defects treated were not restricted to mandibular incisors, as in the present report.

There are few studies concerning the treatment of LGR only in mandibular anterior teeth. Stimmlmayr et al reported a mean root coverage of 86.41% in Class III gingival recession defects after 1 year, similar to what is reported in the present study (80.5%). In Class I and II LGR defects, the obtained results (100% root coverage) were similar to those reported by Harris et al, who compared different flap techniques together with SCTGs.

The proposed treatment achieved a mean statistically significant increase in keratinized tissue of

### Table 1 Descriptive Statistics at Baseline and 12 Months

<table>
<thead>
<tr>
<th>Patient (n)</th>
<th>Age (y)</th>
<th>Tooth (FDI)</th>
<th>Recession class</th>
<th>PD (mm)</th>
<th>RD (mm)</th>
<th>CAL (mm)</th>
<th>KTW (mm)</th>
<th>BD (mm)</th>
<th>12 mo PD (mm)</th>
<th>RD (mm)</th>
<th>CAL gain (mm)</th>
<th>KTW (mm)</th>
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<td>30</td>
<td>31, 31</td>
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<td>8</td>
<td>9</td>
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<td>3</td>
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<td>31, 41</td>
<td>III</td>
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PD = probing depth; RD = gingival recession depth; CAL = clinical attachment level; KTW = keratinized tissue width; BD = bone dehiscence.

### Table 2 Mean Baseline Data and Clinical Outcomes at 12 Months (Mean ± SD)

<table>
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<th>Baseline</th>
<th>12 mo</th>
<th>Difference</th>
<th>P</th>
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<tr>
<td>PD (mm)</td>
<td>1.50 ± 0.70</td>
<td>1.10 ± 0.30</td>
<td>0.40 ± 0.50</td>
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<tr>
<td>RD (mm)</td>
<td>5.25 ± 2.63</td>
<td>1.0 ± 1.24</td>
<td>4.25 ± 1.90</td>
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<tr>
<td>CAL (mm)</td>
<td>6.75 ± 2.63</td>
<td>2.10 ± 1.28</td>
<td>4.65 ± 1.91</td>
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<tr>
<td>KTW (mm)</td>
<td>0.10 ± 0.31</td>
<td>5.90 ± 1.59</td>
<td>5.80 ± 1.75</td>
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Root coverage (%) 86.35 ± 17.30
CRC (%) 50
Root coverage of 3 Class I–II (%) 100
Root Coverage of 7 Class III (%) 80.50 ± 17.80
MRCL Class III (%) 100

*Statistically significant difference (P < .05) between baseline and 12 months.

PD = probing depth; RD = gingival recession depth; CAL = clinical attachment level; KTW = keratinized tissue width; CRC = complete root coverage; MRCL = maximum root coverage level.

The percentage of root coverage was calculated as (recession at baseline – recession at the final examination) / recession at baseline) × 100. CRC was determined when no root surface was detected visibly at the clinical examination in Class I and II gingival recession and MRCL at Class III gingival recession.
5.80 ± 1.75 mm, which is greater than what was reported in similar studies, with mean gains of 2.5 and 2.9 mm (Stimmelmayr et al\textsuperscript{23} and Harris et al\textsuperscript{13}, respectively). Similarly, Nart et al\textsuperscript{20} and Zucchelli et al\textsuperscript{24} combining CTG with CAF, reported mean increases in KTW of 2.50 mm and 2.2 mm, respectively. Even when the flap incision for the bilaminar technique was apical (at the fornix), the reported amount of KT increase was 2.0 mm.\textsuperscript{25} The improved outcomes of the modification of the flattening of the root surface and the two-step surgical approach reported here may be explained by the reduced avascular root surface obtained, which allows increase of the thickness of the gingival margin, extra soft tissue in the open area of the recession, and increased space for the graft achieved by the modified root surface.

Laterally positioned pedicle flaps and coronally advanced flaps are commonly used surgical approaches to treat LGR in mandibular incisors. However, in the presence of a shallow vestibule or lack of keratinized tissue, results using these approaches have clear limitations. These clinical situations may represent the main indications for the proposed treatment concept. The partial coverage of the CTG to avoid flattening the vestibule is, in rare cases, responsible for partial necrosis of the exposed graft, compromising the CRC.\textsuperscript{26} For these reasons, we introduce these modifications. Flattening the root surface creates a new emergence profile with this two-step approach to treat mandibular anterior LGRs in prominent teeth. This approach will provide more space for the graft, increase the thickness of the gingival margin, and provide extra soft tissue at the margins of the recession.

The increased amount of KT and the good esthetic outcomes may also be partially due to the increased space created by the flattening of the root and the subsequent tissue thickening before the surgical intervention. This effect was previously described by Salama et al\textsuperscript{27} with their root submergence technique. However, the extensive odontoplasty may have the noteworthy drawback of increased dentin hypersensitivity, affecting patient morbidity. Nonetheless, to gain tissue on the root surface, it seems necessary to reduce the width of the recession and increase the thickness of the gingival margin. The cases treated presented...
a mean osseous dehiscence of 7.95 mm, which would have increased the risk of necrosis of an exposed graft. Fortunately, 2 months after the root coverage procedure no patient reported any hypersensitivity. Following the protocol of the present study, six cases needed a frenectomy, which was performed 2 months prior to graft surgery. If a frenectomy is not needed, the time between root contouring and the grafting procedure could be reduced by up to 3 to 4 weeks, when the soft tissue has already grown on the root surface of the recessions.

Conclusions

This pilot case series was aimed at presenting a new treatment concept, not to demonstrate efficacy. It therefore has limitations, such as small sample size, and lack of a control group and control for operator and investigator bias. Despite these limitations, excellent results were demonstrated by this treatment concept in terms of root coverage, gains in KT, and improved esthetic outcomes. However, further investigations should be conducted to confirm these results.

Acknowledgments

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References


