Graftless Tunnel Technique for the Treatment of Multiple Gingival Recessions in Sites with Thick or Very Thick Biotype: A Prospective Case Series

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Tunnel (TUN) technique is normally performed in combination with soft tissue grafts, either autogenous connective tissue graft (CTG) or substitutes, regardless of a patient’s biotype. The aim of this study was to investigate the efficacy of graftless TUN in the treatment of multiple gingival recessions (GRs) characterized by thick or very thick biotype. Twenty-seven GRs were treated in seven patients using graftless TUN. At 6-month postoperative evaluations, the mean root coverage (mRC) was 84.57% ± 31.1%, while complete root coverage (CRC) was achieved in 77.8% of treated GR sites and in six out of seven patients. On average, the esthetic evaluation performed using the root coverage esthetic score (RES) resulted in a final score of 9.1 ± 1.4. Sixteen sites achieved the maximum RES score, and in six patients, an RES ≥ 9 was observed in all sites. Graftless TUN showed predictable root coverage and improved esthetics in treating GRs in patients with a thick or very thick biotype. Nevertheless, further studies with a large number of subjects are needed to support these preliminary outcomes.


Gingival recession (GR) has been defined as the apical shift of the gingival margin with respect to the cementoenamel junction (CEJ) with the concomitant exposure of the root surface to the oral cavity.¹ Although the mechanism leading to this condition has not been fully understood,¹ several predisposing factors have been identified, such as inadequate keratinized attached gingiva, thin biotype, shallow vestibule, osseous dehiscence, tooth malposition, and high frenal attachment.² On the other hand, precipitating factors, including recurrent inflammation, vigorous toothbrushing, and self-inflicted injury, are believed to play a major role in the etiology of GRs.² GRs may be associated with esthetic impairment, dentin hypersensitivity, root abrasion, or root caries, which represent the most typical indications for treatment.¹,³ Large evidence is available when evaluating the efficacy of periodontal plastic surgery in treating GRs.⁴,⁵ In particular, coronally advanced flap (CAF) combined with connective tissue graft (CTG) has shown the highest chances of achieving complete root coverage (CRC).⁴,⁶

Since its early introduction in 1994,⁷ the tunnel technique (TUN) has been progressively refined⁸–¹⁰ until gaining popularity among clinicians due to its improved esthetic outcomes, increased blood supply,
quicker healing, and reduced patient morbidity.5,7,8 A recent meta-analysis aimed at evaluating the efficacy of TUN demonstrated comparable results with CAF in terms of mean root coverage (mRC), CRC, and esthetic outcomes when varying graft materials were used.5

Although the addition of CTG or graft substitutes have been found to have preferable outcomes than flap alone,11 not every GR may benefit from the addition of a graft during root coverage procedures.12 Indeed, the presence of an initial gingival thickness (measured at the attached mucosa) > 1.2 mm demonstrates greater chances of obtaining CRC.13 Although increased postoperative marginal gingival thickness following TUN + CTG was found to be a prognostic factor for root coverage,14 it has been suggested that adding a graft in sites with already-thick biotype may be considered an “over-treatment.”12 Indeed, Pini Prato et al showed the long-term efficacy and stability of CAF alone in correcting GRs.15

Increased patient morbidity and surgical time together with higher risk of postoperative complications (including prolonged bleeding, donor site infection, and palatal sensory dysfunction), have been reported as the main drawbacks of CTG.16–18 On the other hand, despite the use of graft substitutes in periodontal plastic surgery, no optimal material has yet emerged to replace the “gold standard” autogenous CTG.6,19,20

While the efficacy of CAF alone has been extensively investigated15,21—leading Chambrone and Pini Prato to conclude that flap preparation and management, as well as gingival thickness, are more important than the addition of CTG, substitutes, or biomaterials12—no studies have investigated graftless TUN in patients with thick or very thick gingival biotype.

Therefore, the aim of this study is to evaluate the clinical efficacy and the esthetic outcomes of graftless TUN in patients presenting with multiple GRs and thick or very thick biotype.

**Materials and Methods**

This study was designed as a two-center prospective case series. Patients were consecutively selected from the Department of Periodontics, University of Milan in Milan, Italy, (center 1) and from a private practice in Kaunas, Lithuania (center 2) according to the following inclusion criteria: (1) 18 years of age or greater; (2) patients with no reported systemic diseases; (3) healthy or stable periodontium; (4) full-mouth plaque score (FMPS) and full-mouth bleeding score (FMBS) both < 20%; (5) multiple GRs ≤ 3 mm with no interproximal attachment loss (Miller Class I or recession type RT1) and associated with esthetic complaint; (6) thick or very thick biotype defined by using a color-coded probe (Colorvue, Hu-Friedy); (7) visible CEJ; and (8) keratinized tissue width (KTW) ≥ 2 mm. The criteria for exclusion were the following: (1) smoking patients; (2) pregnancy; (3) patients taking medications or receiving treatment that could negatively affect the healing of periodontal tissues (eg, steroids); (4) patients who previously received periodontal plastic surgery for the treatment of GRs; (5) inadequate endodontic treatment or tooth mobility at the surgical site; (6) GRs with interproximal attachment loss (Miller Class III or IV, and recession type RT2 or RT3) or GRs beyond the mucogingival junction (Miller Class II); and (7) GRs on molar teeth.

After a thorough explanation of the study protocol and the related risks and benefits, patients provided signed informed consent. The study protocol was in accordance with the Declaration of Helsinki of 1965, revised in Tokyo in 2004. Surgeries were performed by the same experienced periodontist in center 1 (G.R.) and in center 2 (A.Z.L.). Training and calibration meetings were also held to discuss the protocol design and objectives of the study.

**Clinical Measurements**

The following measurements were recorded to the nearest millimeter using the UNC periodontal probe (Hu-Friedy) at baseline and 1, 3, and 6 months:

- **Recession depth (REC):** Distance from the free gingival margin to the CEJ at the midfacial aspect of the tooth
- **Probing depth (PD):** Measured in the midfacial site
- **Clinical attachment level (CAL):** Calculated in the midfacial site as REC + PD
- **KTW:** Distance from the free gingival margin to the mucogingival junction at the
midfacial point. Gingival biotype was evaluated at baseline and at 6 months using Colorvue probes (Hu-Friedy). The Colorvue Biotype system was explained in the previous article by Rasperini et al. Esthetic evaluation was performed at 6 months using the root coverage esthetic score (RES). This score system evaluated five parameters at the 6-month follow-up: 1) level of the gingival margin (GM), marginal tissue contour (MTC), soft tissue texture (STT), mucogingival line alignment (MGJ), and gingival color (GC).

**Presurgical Treatment**

Each study participant received full-mouth supragingival scaling, polishing, and oral hygiene instruction at least 1 month before the scheduled surgery. The patients were instructed on optimal toothbrushing technique, dental floss, and/or interdental cleaning.

**Surgical Procedures**

TUN was performed as described by Aroca et al (Figs 1 and 2). Briefly, after intrasulcular incisions, a tunnel microelevator (Tunneling knives #1 and #2, Hu-Friedy) was used to raise a mucoperiosteal flap, which was then extended at least one tooth mesial and distal to the surgical area. The flap was next mobilized by extending the detachment beyond the mucogingival junction and then by keeping the blade parallel to the external mucosal surface, cautious of avoiding perforations. Additionally, the papillae were detached from the bone using a papilla elevator (Tunneling knives #1 and #2, Hu-Friedy). When the flap could passively reach a level that was 1 mm coronal to the CEJ, suspended sutures (Polypropylene 6/0, Ethicon, Johnson & Johnson) were performed above the splinted contact points.

Fig 1 Graftless TUN in a patient presenting with multiple mandibular GRs: (a) Baseline, (b) after surgery, and the (c) 3-month and (d) 6-month follow-ups.

Fig 2 Graftless TUN in a patient presenting with multiple maxillary GRs: (a) Baseline, (b) Tension-free flap, (c) Immediately after surgery and (d) the 6-month follow-up.
Postsurgical Instructions

Each patient was given 600 mg of ibuprofen immediately before the surgery and was then instructed to take another dose of 600 mg after 6 hours. Further doses were taken only if needed. It was recommended to intermittently apply an ice bag on the operated area for the first 2 hours. Patients were instructed to rinse twice daily with 0.2% chlorhexidine and to avoid any mechanical trauma, toothbrushing, and excessive muscle traction in the surgical area for 4 weeks. No interdental cleaning was allowed in the first 4 weeks.

Sutures were removed after 14 days, and patients were instructed to resume mechanical brushing using a postsurgical toothbrush for the first 3 months. Patients were then recalled at 1-, 3-, and 6-month follow-ups for prophylaxis and reinforcement of brushing instruction.

Evaluation of Intra- and Postoperative Morbidity

Intra- and postoperative morbidity were evaluated using questionnaires, including dichotomous questions and a 100-mm visual analogue scale (VAS). The following parameters were investigated: intraoperative pain; intraoperative discomfort; postoperative pain; need for additional painkillers; number of painkiller tablets taken; impact of the surgery on daily activities; and postoperative complications. In particular, patients were asked after the surgery to answer questions regarding the first two parameters, while questions about the other parameters were answered at the 1-week appointment.

Data Analysis

Data were expressed as mean ± standard deviation, obtained from 27 GRs in seven patients. All patients enrolled in the present study completed the 6-month study protocol. Comparisons between baseline and 6-month REC values were performed using paired Student t test (α = .05). The primary outcome variables were REC and RES scores (GM, MTC, STT, MGJ, and GC), and patient morbidity was the secondary outcome.

Results

Baseline Characteristics

Twenty-seven GRs were treated in seven patients (three males, four females) using graftless TUN. Patient characteristics at baseline are depicted in Table 1. The mean age of patients was 40 ± 12.5 years (minimum: 23 years; maximum: 56 years). The treated sites consisted of eight maxillary and six mandibular incisors, four maxillary and two mandibular canines, and five maxillary and two mandibular premolars. Baseline FMPS and FMBS were 10.3% ± 1.7% and 10.4% ± 1.9%, respectively. Four patients presented with thick gingival biotype, and three showed very thick gingival biotype (Table 1). Average baseline REC was 2 ± 0.4 mm.

Clinical Outcomes at 1, 3 and 6 Months

REC change over the follow-up period is presented in Table 2. At 1 month, REC was an average of 0.4 ± 0.7 mm, while it was 0.3 ± 0.6 mm at 3 and 6 months. Similarly, the mRC was 81.5% ± 34.3% at 1 month and increased to 84.57% ± 31.1% at 3 and 6 months. Differences in REC at baseline and at 6 months were clinically and statistically significant (P < .01). At 6 months, CRC was observed in 77.8% of sites. In particular, CRC was achieved in all treated GRs in 6 out of 7 patients, while in one patient, CRC was obtained only in 1 of 7 GR sites (Table 2). The aesthetic evaluation was performed at 6 months using the RES. Sixteen sites

Table 1 Characteristics of Study Subjects at Baseline

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Gender</th>
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<th>FMPS</th>
<th>FMBS</th>
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<tr>
<td>2</td>
<td>F</td>
<td>32</td>
<td>10</td>
<td>12</td>
<td>Thick</td>
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FMPS = full-mouth plaque score; FMBS = full-mouth bleeding score.
achieved the maximum score (10), and in six patients out of seven, an RES ≥ 9 was observed at all treated sites. The mean RES was 9.1 ± 1.4. Table 3 reports the GM, MTC, STT, MGJ, and GC for each site treated.

### Patient Morbidity

The average VAS scores for intra- and postoperative pain (during the first week) were 0.9 ± 0.4 and 0.4 ± 0.5, respectively. Two patients out of seven needed additional painkillers; six subjects reported edema and two hematomas.

### Discussion

TUN has been shown to be an effective technique for treating GRs while providing a faster healing time and remarkable esthetics compared to pedicle approaches.\(^5,7,8,24\) Particularly, TUN is combined with graft use, either CTG or substitutes.\(^5\) While there is no doubt to the advantages provided by CTG (which include higher chances of achieving CRC, increased tissue thickness, improved esthetics, and induction of keratinization of the overlying epithelium\(^10\)), the significant postoperative patient morbidity related to CTG has led clinicians to explore alternative materials, such as acellular dermal matrix or collagen matrix.\(^10\) These grafts underwent a process of decellularization for removing antigenic components and therefore serve as a scaffold, promoting the migration of cells from the adjacent tissues.\(^19\)

The results from the present study showed the efficacy of graftless TUN in patients with thick or very thick gingival biotype, with an average mRC and CRC of 84.6% and 77.8%, respectively. In line with the present findings, it has been suggested that tissue thickness plays a crucial role in root coverage.
outcomes with respect to flap preparation, marginal flap stability in the early healing, the chances of obtaining CRC, and the likelihood of attaining a long-term “creeping attachment” phenomenon. In addition, flap elevation during TUN is easier and less prone to fenestration in presence of thick soft tissue. Gingival thickness can be assessed by transgingival probing, ultrasonic measurements, and probe visibility. In particular, the color-coded probes first described by Rasperini et al demonstrated that patients with thin gingival biotype are more prone to gingival margin instability following orthodontic treatment.

To the best of the authors’ knowledge, this is the first study investigating TUN without the addition of a graft in the treatment of GRs. Reduced patient morbidity and surgical time, as well as ease in soft tissue manipulation (given the thick/very thick biotype), are among the main advantages of this approach. Vincent-Bugnas et al achieved an mRC of 88% using TUN without CTG or graft substitutes; however, the use of enamel matrix derivatives may explain their satisfying outcomes. Among the factors that may have contributed to the amount of mRC observed in the present study, it should be mentioned that only shallow GRs with a KTW of at least 2 mm with no interproximal attachment loss have been treated. Indeed, lower outcomes are expected when performing TUN in Miller Class III GRs compared to Miller Classes I and II GRs. Aroca et al demonstrated that the probability of CRC decreases when the distance between the tip of the papilla and the contact point increases. Similarly, KTW has been
shown to be a prognostic factor for CRC, and this seems to be particularly crucial when graftless TUN is performed.

Tooth location has also been identified as a crucial factor affecting the results of root coverage procedures. The present prospective study consecutively included patients presenting multiple GRs either in the maxilla or in the mandible, without observing any significant differences in the final outcomes. Lastly, the present RES final score (9.1 ± 1.4) was in line with the studies of Zuhr et al. and Azaripour et al., which obtained RES scores of 9.1 ± 0.8 and 9.2 ± 1.1, respectively, following TUN + CTG. Therefore, graftless TUN in patients with thick or very thick gingival biotype seems to be able to provide satisfying outcomes even without the addition of a CTG or a graft substitute.

Within the limitation of the present investigation, it should be mentioned that the results are based on a small sample size and that the study design lacks a control group, thus preventing definitive conclusions from being drawn regarding the efficacy of the proposed approach.

Conclusions

Within its limitations, the present study presented a graftless TUN approach in patients presenting with multiple shallow GRs and thick or very thick biotype. This technique resulted in significant recession reduction and improved esthetics, minimizing patient intra- and post-operative discomfort. Nevertheless, further studies with a large number of subjects are needed to support these preliminary outcomes.

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References


