Case Report 2

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The Dependability of Connective Tissue Grafting for the Resolution of Full-Mouth Recession

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ABSTRACT

Based on its ability to treat a broad range of mucogingival defects and predictability, autogenous subepithelial connective tissue grafting (CTG) remains the standard of care for gingival recession. Its advantages often outweigh the drawbacks, which include the preparation of a second surgical site (typically in the palate) for donor tissue collection and a finite volume of graft material available. Extensive recession requires multiple CTG surgeries and palatal re-entry. This case report documents successful full-mouth CTG performed in four sessions over 3 years. Complete root coverage was obtained around all but one of 24 teeth.

Gingival recession usually has a multifactorial cause; however, only one solution is required typically—autogenous subepithelial connective tissue grafting (CTG). As the "go to" therapy for mucogingival defects, connective tissue autografts provide a mean root coverage (MRC) of 85%, and 60% of defects become completely covered; such results best those of other interventions, including coronally positioned flaps (80% MRC vs 50% [complete root coverage [CRC]), guided tissue regeneration (75% vs 40%), laterally positioned flaps (70% vs 40%), and free gingival grafts (60% vs 30%).[1] Moreover, connective tissue transplants are used to treat the greatest diversity of recession types (thin or thick mucosa, wide or shallow deformities, little or abundant keratinized mucosa, single or multiple roots) and blends well with the surrounding native mucosa; only the use of human acellular dermal matrix (ADM) rivals CTG. The major shortcoming of CTG is the need for a second surgical site—usually palatal—from which to harvest mucosa; this consumes time, introduces infection risk to the mouth, causes bleeding and pain, and restricts the volume of graft available based on donor site anatomy.[2-5] In cases of widespread recession, CTG should be supplemented with ADM, especially in patients who have appointment frequency constraints. Alternating autogenous and allogenous material use in recipient sites allows the surgeon to perform multiple quadrant root coverage in one sitting. But do receded areas respond as well to ADM as they do to connective tissue?

Based on a few relatively short-term (6 months) studies, CTG and ADM seem to generate comparable MRC and color match outcomes.[6] However, these results differ over time; after 4 years, the MRC achieved via connective tissue application remains at 97% while the MRC in regions treated by ADM drops from an initial 93% to 66%.[7]

Because of the robust evidence in favor of CTG regarding efficacy and sustainability, CTG remains the gold standard for root coverage care, as supported by several systematic reviews and meta-analyses. Thoma and colleagues found more consistent volume gain by CTG compared with free gingival grafting.[8] Likewise, the Clauser, Chambrone, and Oates groups independently reported higher predictability of root coverage and keratinized tissue widening with CTG than with several alternatives, including guided tissue regeneration and allografting.[1,9,10] If a patient with extensive recession consents to a number of surgical procedures spaced over several months or even years, then this therapy is the option that guarantees the most consistency. The case presented here describes full-mouth recession reversed by CTG alone over 3 years.

CLINICAL AND RADIOGRAPHIC EXAMINATIONS

A healthy, nonsmoking 17-year-old man presented with recession defects spanning teeth Nos. 3 to 6, 11 to 14, and 19 to 30 (Figure 1 through Figure 7). He complained of esthetic compromise and cold hypersensitivity.

One year prior to presentation, the patient had completed full-mouth orthodontic treatment, which attempted to compensate for a Class III malocclusion associated with a skeletal Class III discrepancy. Orthodontic movement was unable to transform the occlusion to a Class I or eliminate crossbites, although some resolution occurred.

On examination, the patient exhibited generalized mild, localized moderate gingivitis with probing depths of 1 mm to 3 mm. An absolute lack of attached tissue or the presence of only < 1 mm of attached tissue exacerbated the inflamed and/or edematous appearance of the gingival margins around teeth Nos. 3, 5, 11, 14, 19, and 21 to 30. All recession defects were categorized as Miller Class I except for those on teeth Nos. 3 and 14, which were determined to be Miller Class II. No interproximal attachment loss or mobility was detected. The patient exhibited a relatively thin gingival biotype, as well as a coronally displaced maxillary midline frenum.

A full-mouth radiographic series showed no bone loss, periapical pathology, periodontal ligament (PDL) widening, or caries (Figure 8). All third molars were present, with an impacted tooth No. 17.

TREATMENT PLAN

Based on the Miller Class I and Class II diagnoses of the receded areas (ie, recession coronal to or at the level of the mucogingival junction without interproximal attachment loss), the prognosis


Fig 1.


Fig 2.


Fig 3.


Fig 4.


Fig 5.


Fig 6.


Fig 7.

Fig 1. Initial patient presentation in June 2005. Frontal view. Notice Class III malocclusion and generalized recession defects. **Fig 2.** Maxillary right side view reveals Miller Class I recession on teeth Nos. 4 to 6, Miller Class II recession over tooth No. 3, and a lack of minimal keratinized tissue over teeth Nos. 3 and 5. **Fig 3.** Maxillary anterior view depicts Miller Class I recession on teeth Nos. 6 and 11 and a dearth of keratinized mucosa over tooth No. 11. There is a thin tissue biotype. **Fig 4.** Maxillary left side view reveals Miller Class I recession on teeth Nos. 11 to 13 and Miller Class II recession over tooth No. 14. There is a lack of adequate keratinized gingiva over teeth Nos. 11 and 14. **Fig 5.** The lower right side view shows Class I recession from teeth Nos. 27 to 30 and minimal keratinized tissue over the same teeth. **Fig 6.** Miller Class I recession and lack of keratinized gingiva evident on teeth Nos. 22 to 27. **Fig 7.** Miller Class I recession on teeth Nos. 19 to 21 with deficient keratinized mucosa over all teeth except No. 20.

was deemed good.[11] For final stage predictability, the team opted to partition the CTG treatment into four procedures, each scheduled during the patient's annual summer holidays. It was decided to convert the patient from a thin to thick biotype in hopes of discouraging future recession, so that teeth without recession (Nos. 7 to 10) also received grafting. Nine to 13 months of healing occurred between surgeries to ensure adequate palatal regeneration. The patient's grafting schedule was as follows:

2005: Teeth Nos. 9 to 14
2006: Teeth Nos. 3 to 8
2007: Teeth Nos. 21 to 28
2008: Teeth Nos. 19, 20, 29, and 30

SURGICAL PROTOCOL

Each grafting procedure was executed according to the steps outlined in this section (Figure 8 through Figure 24). A maxillary midline frenectomy was also performed at the time of grafting at teeth Nos. 9 to 14.

Sedation and Anesthesia

Sedation was performed intravenously. Anesthesia with 2% lidocaine with 1:100,000 epinephrine, 4% articaine with 1:200,000 epinephrine, and 0.5% bupivicaine with 1:200,000 epinephrine was given at the recipient site via local infiltration one tooth past each terminal tooth to be grafted. The bilateral palatal donor sites were anesthetized via local infiltration using the formulations described above.

Flap Design and Site Preparation

Recipient site: Buccal sulcular incisions were made along each tooth to be grafted and extended one tooth past each distal-most one. A full-thickness flap was elevated past the mucogingival junction, and the periosteum was scored near the base of the

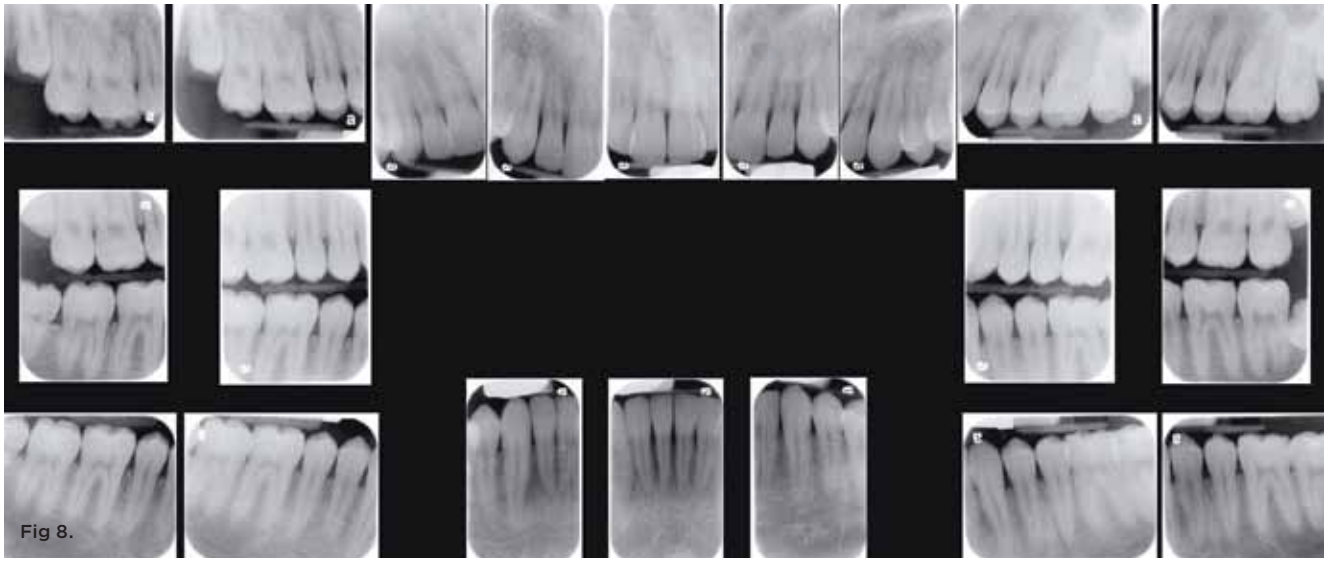
Fig 8.


Fig 9.


Fig 10.


Fig 11.


Fig 12.

Fig 8. Initial full-mouth radiographic series. There is no apparent bone loss, periapical pathology, widened PDL spaces, or caries. All third molars are present, with an impacted tooth No. 17. **Fig 9.**First connective tissue grafting surgery for teeth Nos. 9 to 14 (July 2005). The aim was not only to correct recession defects but also to convert the biotype from thin to thick. The final closure with 4-0 ePTFE is depicted here with primary coverage over the connective tissue grafts. A frenectomy was performed at the maxillary midline. **Fig 10.** Second CTG surgery for teeth Nos. 3 to 8 (July 2006). Significant Nos. 5 and 6 root prominences exist. Notice the normal alveolar crest to cementoenamel junction relationship on teeth Nos. 7 and 8. **Fig 11.** Two segments of palatal connective tissue have been adapted to cover the teeth Nos. 3 to 8 root surfaces entirely and secured in place by 5-0 plain gut sutures. The graft remained immobile. **Fig 12.** EThe flap is sutured over the graft with 4-0 ePTFE. A close-up of anterior suturing. There has been coronal positioning of the overlying flap. However, as site No. 5 shows, small segments of connective tissue remain exposed.

flap to facilitate coronal advancement (Figure 10). The site was degranulated with a carbide finishing bur and Neumeyer bur. To create flat surfaces required for graft adaptation, any exposed radicular surfaces were root planed and leveled to the buccal plate using a 7/8 Gracey curette, carbide finishing bur, and Neumeyer bur. Cotton pellets soaked with tetracycline solution were applied for 2 to 5 minutes, after which the root surfaces were irrigated with sterile water (Figure 14).

Donor site: Following the design described by Langer and Langer, two subepithelial connective tissue grafts were harvested bilaterally from the palate[12] (Figure 13). A No. 15 scalpel was used. Each side of the palate received a full-thickness linear incision extending from the distal aspect of the canine to the mesial aspect of the second molar and lying at least 4-mm apical to the marginal gingiva of the teeth. The greater palatine foramina were identified. On each side, a secondary split-thickness incision was made parallel to the slope of the palate such that a 1-mm to 1.5-mm epithelial layer was left. This secondary incision was extended along the entire length of the first cut and at a depth of approximately 10 mm. Tertiary full-thickness vertical incisions were made at the terminal ends of and perpendicular to the primary incision (approximately 10-mm deep). A final incision was created along the apical base of the donor site, below the epithelium. The scalpel-delineated connective tissue was elevated and extracted from under the epithelial layer with a periosteal instrument and tissue forceps. The bilateral incisions were primarily closed with 4-0 expanded polytetrafluoroethylene (ePTFE). The two connective tissue grafts were trimmed with a No. 15 scalpel to conform to the defect morphology.

Graft Stabilization and Closure

The connective tissue grafts were positioned over the recipient root surfaces and secured by sling and periosteal sutures with 5-0 plain gut (Figure 9, Figure 11, Figure 12, and Figure 18 through Figure 20). The flap was positioned coronally to cover the CTG and sutured with 4-0 ePTFE in a simple interrupted configuration. Primary closure was planned, although minor segments of graft material were occasionally exposed.

Bioactive Adjuncts

A bioactive agent was employed during the final surgery (teeth Nos. 19, 20, 29, and 30). Extracted from autologous blood, plasma rich in growth factors (PRGF) contains various degrees of anabolic elements, chemokines, and active metabolites.[13] The growth factors consist of platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), insulin growth factor-1 (IGF-1), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF). In theory, these substances hasten healing and tissue formation.


Fig 13.


Fig 14.


Fig 15.


Fig 16.


Fig 17.

Fig 13. Third CTG surgery for teeth Nos. 21 to 28 (May 2007). Bilateral palatal grafts, comprising a total dimension of 50 mm by 7 mm, were harvested and trimmed to conform to the recession defects. **Fig 14.** Cotton pellets soaked in tetracycline were applied to the recipient roots for 5 minutes. **Fig 15.** The two grafts were closely adapted and secured to the root surfaces by sling and periosteal anchorage using 5-0 plain gut. **Fig 16.** Initial flap positioning over the grafts. Notice the uncovered areas at the midlabial of the anterior teeth. **Fig 17.** At 10-month, 20-month, and 32-month follow-up of grafted areas Nos. 21 to 28, Nos. 3 to 8, and Nos. 9 to 14, respectively (March 2008). There is symmetry between the maxillary and mandibular anterior teeth, as well as a thickened biotype.

Autologous PRGF was prepared via the method described by Anitua.[13] A total of 30 mL of blood was drawn from a peripheral vein in the right antecubital fossa into tubes coated with sodium citrate anticoagulant. The blood was centrifuged for 8 minutes at 460 x g. Extraction of a 0.5 mL plasma fraction above the red blood cell sediment, and buffy coat layer from each tube occurred. This PRGF liquid was applied directly on top of the stabilized connective tissue grafts. The flap was subsequently sutured over the PRGF-saturated donor tissue.

Postoperative Instructions

After each surgical procedure, the patient was instructed to take ibuprofen 600 mg every 4 to 6 hours, hydrocodone 7.5 mg/acetaminophen 750 mg every 4 to 6 hours as necessary for pain, and


Fig 18.


Fig 19.


Fig 20.


Fig 21.


Fig 22.


Fig 23.


Fig 24.

Fig 18. Fourth CTG surgery for teeth Nos. 19, 20, 29, and 30 (May 2008). The connective tissue graft sutured in place over teeth Nos. 19 and 20. Grafts on the right and left sides were treated with plasma rich in growth factors, which does not alter the transplant appearance. **Fig 19.** The flap was coronally advanced to cover the Nos. 19 and 20 graft. **Fig 20.** The flap was coronally advanced to cover the No. 29 and 30 graft. **Fig 21.** TFollow-up at 14 months, 23 months, 36 months, and 48 months of grafted areas Nos. 19, 20, 29, 30, 21 to 28, 3 to 8, and 9 to 14, respectively (July 2009). Evident in this frontal view is a harmonious gingival contour in the maxilla and mandible. The frenum is situated more apically than its original position. **Fig 22.** The right lateral view shows complete root coverage over all areas except No. 30, which has approximately 0.5 mm to 1 mm of root exposure. **Fig 23.** The left lateral view displays full root coverage of all teeth. **Fig 24.** The maxillary anterior view reveals total root coverage with thick keratinized mucosa.

doxycycline 100 mg once a day for 10 days. He was directed not to brush at or near the surgical site for 3 weeks but instead to rinse with 0.12% chlorhexidine or warm saline twice daily. Suture removal occurred at 7 to 10 days postsurgery.

HEALING

The patient had no significant postsurgical discomfort, and healing was uneventful (Figure 17). Minor food impaction was seen around tooth No. 30 approximately 4 weeks after the grafting operation of that side; this may have influenced the root coverage result as 100% defect resolution was not obtained. The application of PRGF to the graft material over sites Nos. 19, 20, 29, and 30 generated a tissue appearance similar to that seen after grafting in areas not treated with PRGF.

A maturation of 9 to 13 months occurred between each CTG appointment. There has been a 14-month to 4-year follow-up of grafting results.

ROOT COVERAGE

CRC was achieved in all areas except No. 30, which had 0.5 mm to 1 mm of exposed root surface (Figure 21 through Figure 24). Coverage has been maintained for at least 14 months after surgical completion. There is more than a 1-mm band of attached gingiva supporting each tooth, and the biotype has been thickened. A frenectomy effectively relocated the maxillary midline frenum to a more apical position, decreasing the chance of tissue pull.

DISCUSSION

There seems to be no thoroughly documented procedure that rivals connective tissue grafting with respect to the range of treatable conditions, root coverage results, and long-term stability. That is not to say that other techniques fail to show promise or unique benefits. Guided tissue regeneration for recession defects potentially regenerates the attachment apparatus, while ADM grafting does what CTG does without the problem of finite availability.[1] Both therapies avoid the morbidity associated with a second surgical site. Even the old standard of care—free gingival grafting—supplies more keratinized tissue. Still, the relative unpredictability (or undetermined reliability) of these methods makes CTG attractive, multiple surgeries aside. As the case above demonstrates, the palate has an excellent capacity for renewal given time, and re-harvesting without complications is possible. Treating mucogingival defects with subepithelial tissue transplants not only entirely resolves root exposure issues but also normalizes the width of keratinized tissue in cases of Miller Class I or Class II recession, providing the patient with an ideal smile and a healthy, symptom-free mouth.

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