Increasing Contact Between Soft Tissue Graft and Blood Supply

A Technique for Managing Connective Tissue Grafting Over Prominent Root

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Abstract

When repairing gingival recession in areas of malpositioned teeth and prominent roots, even if there is no interproximal hard and soft tissue loss, conventional soft tissue grafting techniques can lead to unpredictable results. Teeth with prominent roots or root surfaces positioned outside the alveolar housing often have concavities between the tooth and the adjacent bone. Placing a soft tissue graft over a prominent root and these adjacent concavities can result in dead space and reduced blood supply to the donor soft tissue graft, which can affect graft success. This article presents a modified soft tissue grafting technique that utilizes particulate bone graft to support donor connective tissue as a means to reduce dead space, increase contact between soft tissue graft and blood supply, and achieve predictable esthetic and harmonious root coverage in areas of recession over prominent roots.

Key Words: cosmetic and esthetic dentistry, gingival contouring, periodontics, soft tissue grafting

Introduction

Correction of gingival recession and mucogingival deformities around natural teeth through soft tissue grafting to improve the health, esthetics, and harmony of the gingival margin has become common practice. There are a number of options for treating gingival recession, including free gingival grafts, connective tissue grafting, sliding pedicle grafts, coronally repositioned flaps, and the use of accellular dermal matrices.[1-5] Advances in these techniques as well as in diagnosis and classification of defects have led to predictable outcomes in treatment of Miller Class I and II defects, but predictable root coverage is still difficult to achieve through conventional means in more advanced defects or areas of root prominence and malpositioned teeth.[6]

Correction of gingival recession in areas of malpositioned teeth and prominent roots, even in cases with little to no interproximal hard or soft tissue loss, can have variable outcomes.[7] The lack of predictability in these cases is the result of reduced blood supply to the donor soft tissue during graft healing. Teeth with prominent roots and root surfaces positioned outside the alveolar housing have adjacent concavities between the root and bone, and placing a soft tissue graft over a prominent root and its adjacent concavities will lead to dead space between the alveolar bone and the donor tissue. This lack of contact between the donor tissue and the blood supply of the alveolus and periodontal ligament (PDL) reduces the blood supply to the graft.[8] Such a reduction, especially during the first few days when a graft is dependent on plasmatic circulation, can negatively affect the graft's success and therefore decrease the amount of achievable root coverage.[9]

A technique designed to reduce dead space and increase contact between soft tissue grafts and blood supply was implemented in a series of 20 cases. The purpose was to achieve soft tissue coverage in cases of gingival recession on teeth with prominent roots based on the biologic foundations of wound healing. Two cases are presented in their entirety and photographic long-term follow-up of the other 18 cases has been included to demonstrate the technique's predictability **(Figs 1a-18b)**.

> "The purpose of the bone graft material is to form a ramp on either side of the prominent root, creating a level recipient bed for the donor tissue."

Modified Connective Tissue Grafting Technique

Preoperative

The technique was used in 20 cases that presented with gingival recession in areas of root prominence, with minimal loss of interproximal hard and soft tissue. Patients were treated with a one-week course of antibiotics beginning the day before treatment as well as with an antimicrobial rinse beginning 24 hours after completion of the grafting procedure. Immediately before the procedure patients were disinfected periorally and intraorally.

Tissue Harvesting

A full thickness envelope flap with intrasulcular and papilla slicing incisions was created in the area of the recession, spanning from one to two teeth on both sides of the area in need of soft tissue augmentation. No vertical incisions were made. Donor connective tissue of adequate width and height to repair the defect was harvested from the palate. The authors recommend beginning harvesting of the connective tissue from the distal of the canine and extending to the midpalatal of the second molar if needed, being careful to remain 3 to 4 mm from the free gingival margin, as well as taking all other palatal anatomical limitations and landmarks into consideration.[10] Connective tissue was harvested through the use of a full thickness envelope flap on the hard palate. After harvesting, the palate was sutured with a continuous or interrupted approach. The exposed root surfaces were thoroughly cleaned with hand scalers (they also can be treated with a root conditioner such as ethylenediaminetetraacetic [EDTA] acid to further aid in removing debris from the root surface). The exposed alveolar bone was thoroughly debrided. The concavities in the alveolar housing adjacent to the prominent roots were noted and this area was carefully decorticated with a small-diameter bur.

Bone Graft Material

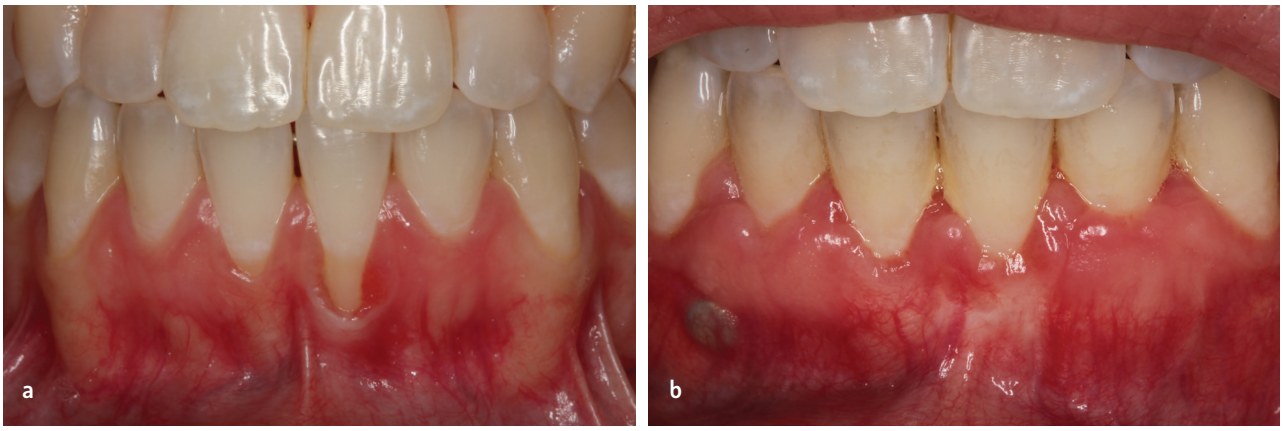
Small-particle mineralized cancellous bone allograft (MCBA) (Puros, Zimmer Dental; Carlsbad, CA) was packed into the concavities to create a level recipient bed for the connective tissue graft. Small-particle mineralized allograft was chosen due to its handling and physical properties, but clinicians may choose to employ the bone graft material that they feel adequate. The purpose of the bone graft material is to form a ramp on either side of the prominent root, creating a level recipient bed for the donor tissue. The graft material also serves to eliminate dead space and to wick or draw blood from the exposed alveolar bone up to the recipient graft bed.

Suturing

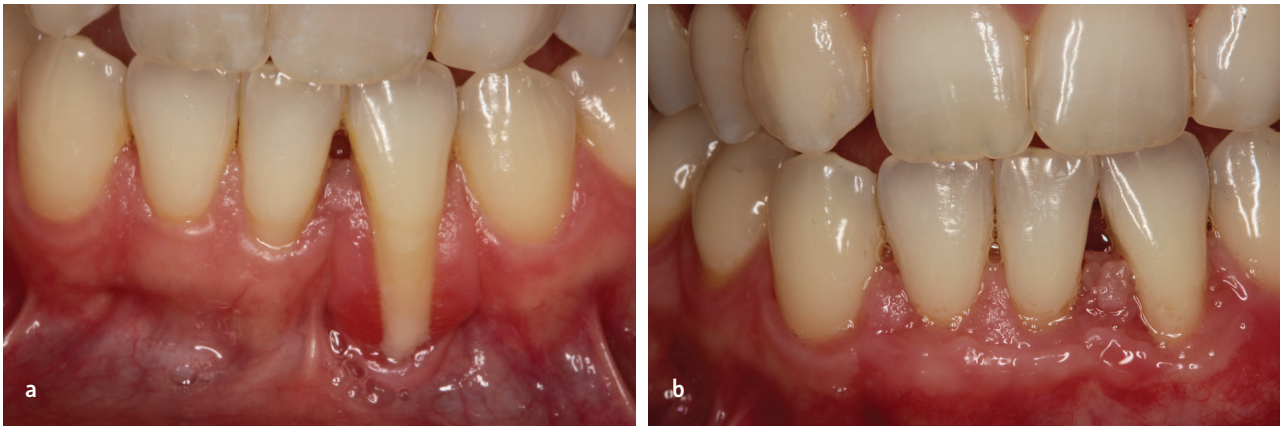
The harvested connective tissue graft was placed over the bone graft and areas of recession and stabilized with interrupted sutures through the coronal portion of the graft and the sliced papilla. The full thickness flap was then repositioned coronally and secured in place with a combination of sling sutures and soft tissue glue. The graft was stabilized with single interrupted sutures and the coronally repositioned flap of the recipient site was stabilized with single sling sutures. The criss-cross suture technique secures soft tissue grafts in place by grabbing the base of the flap and extending the suture over the graft; going through the papilla or around the teeth is purposely avoided. The criss-cross technique compresses the soft tissue graft, limits the coronal advancement of the overlaying flap, and creates tension at the base of the overlaying flap. Single interrupted sutures through the coronal portion of the graft and sliced papilla are employed to avoid compression of the donor tissue and bone graft and facilitate advancement of the overlying flap. Securing the flap at its coronal portion with single interrupted sutures and avoiding criss-cross sutures extending through the base of the advanced flap allows greater advancement of an intact overlying flap and prevents an apical migration of the overlying flap from tension at its base. The authors' chosen method of suturing is an integral part of the modified connective tissue grafting technique. This technique's success can be seen in all the postoperative images.

> "Increasing the blood supply to the grafted tissue is critical because it is entirely dependent on plasmatic circulation or diffusion of nutrients from the surrounding area during the first few days of healing."

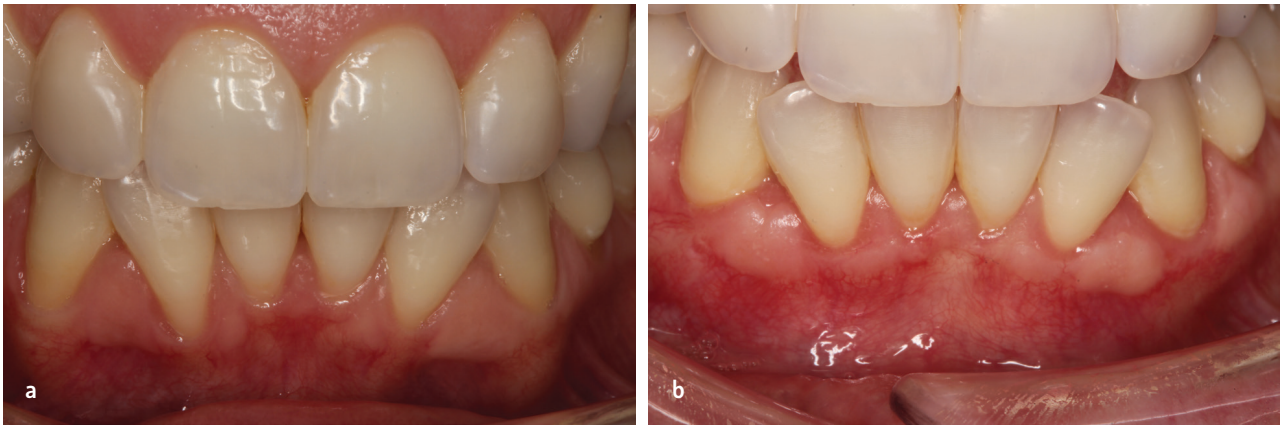
18 Long-Term Follow-up Cases, Miller Classification



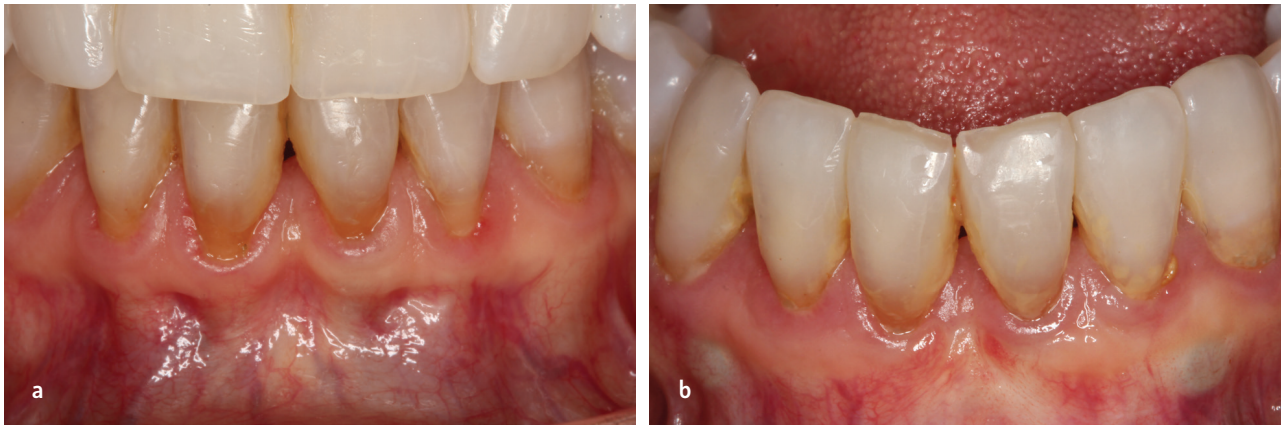
Figures 1a & 1b: Class II on #24, and six months postoperative.



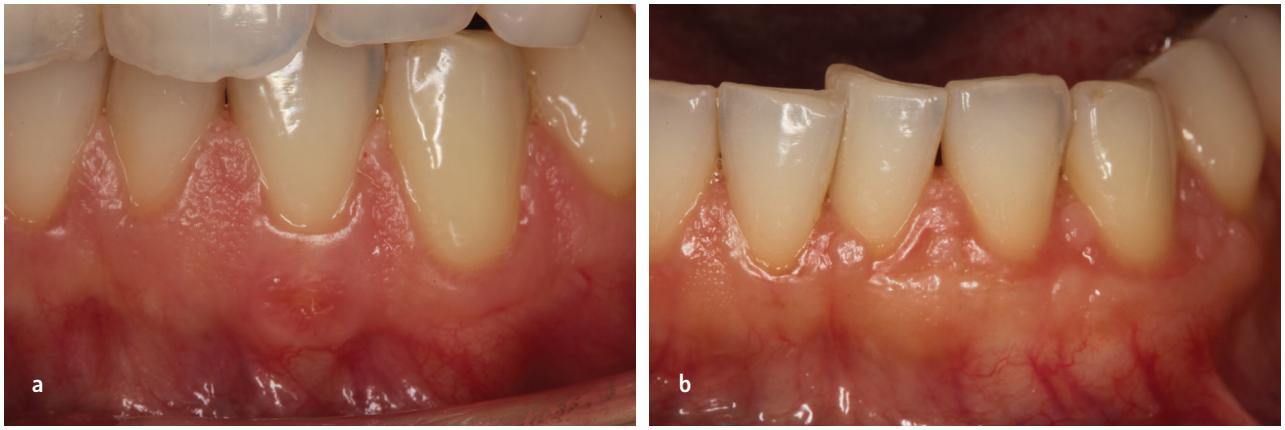
Figures 2a & 2b: Class III on #23 with root prominence, and three years postoperative.



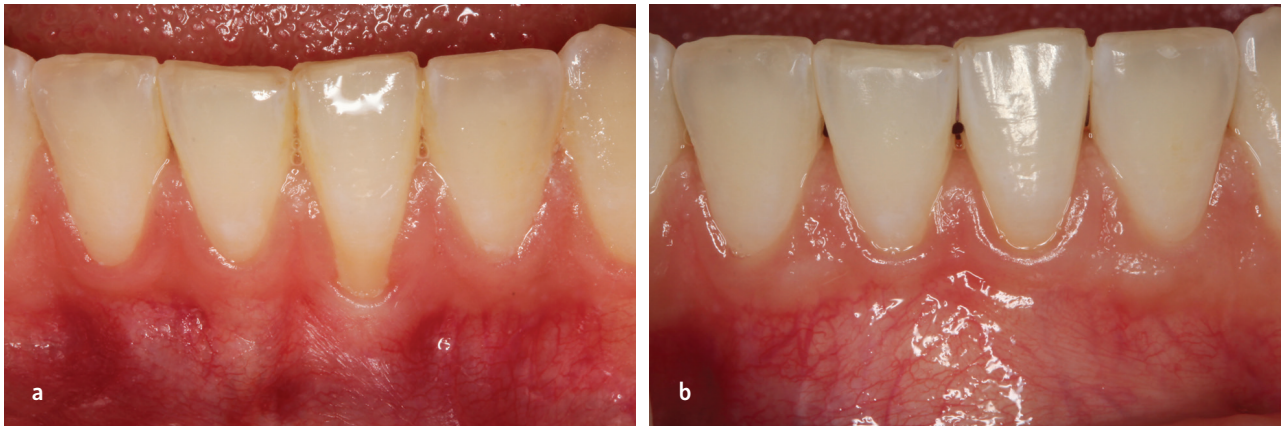
Figures 3a & 3b: Class II on #23 and #26, and one year postoperative.



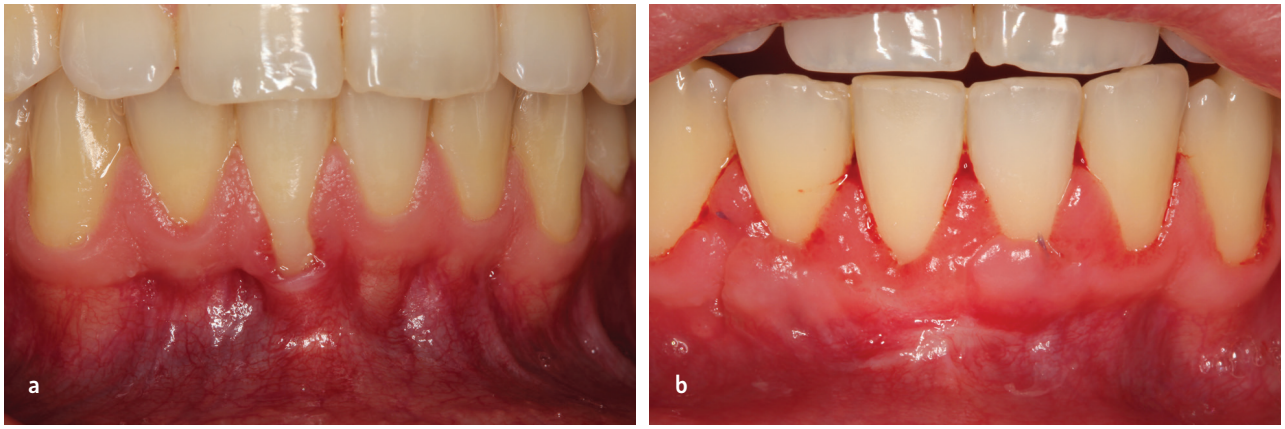
Figures 4a & 4b: Class II on ##23-26, and two years postoperative.



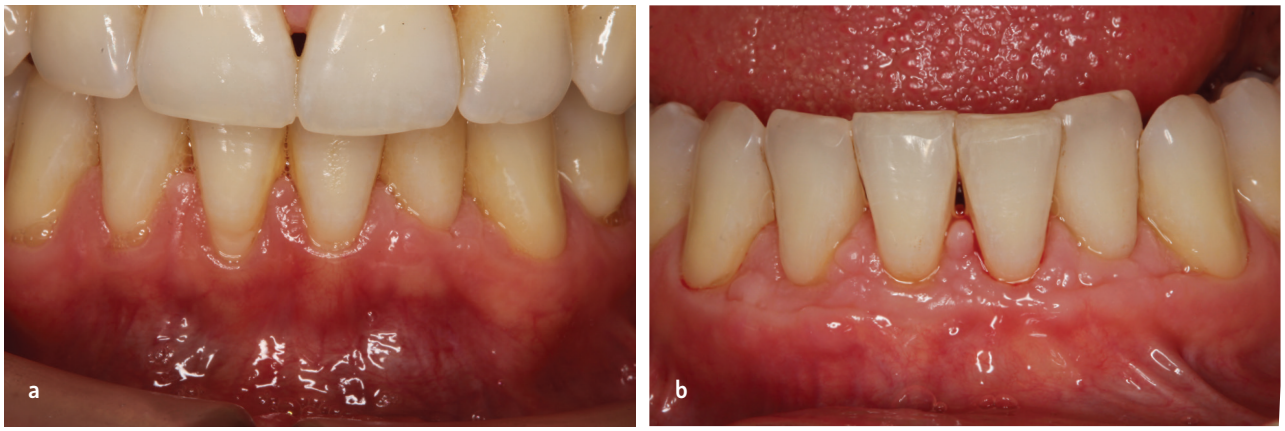
Figures 5a & 5b: Class II on #23 with root prominence and tissue dehisence, and one year postoperative.



Figures 6a & 6b: Class II on #24, and two years postoperative.

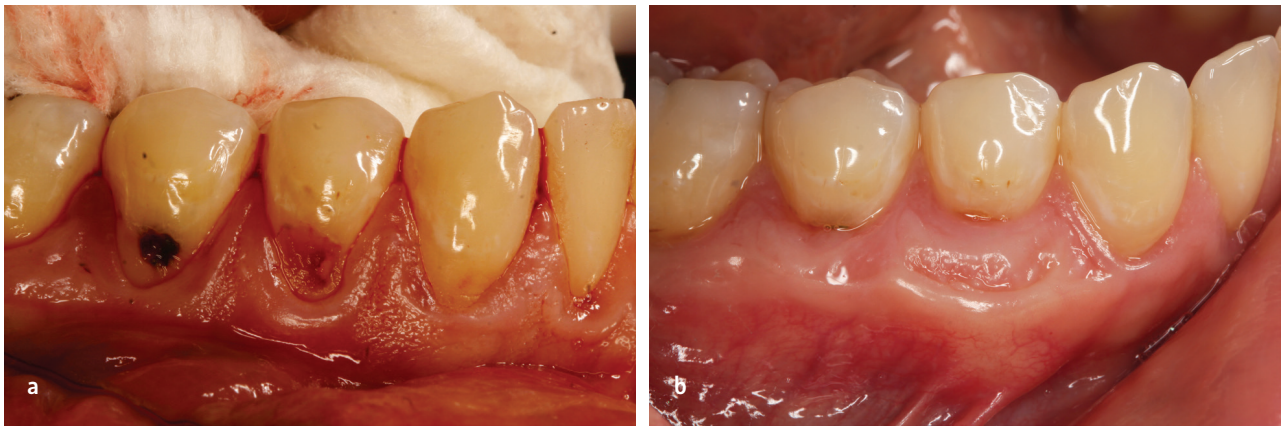


Figures 7a & 7b: Class II on #25 with root prominence, and six months postoperative.

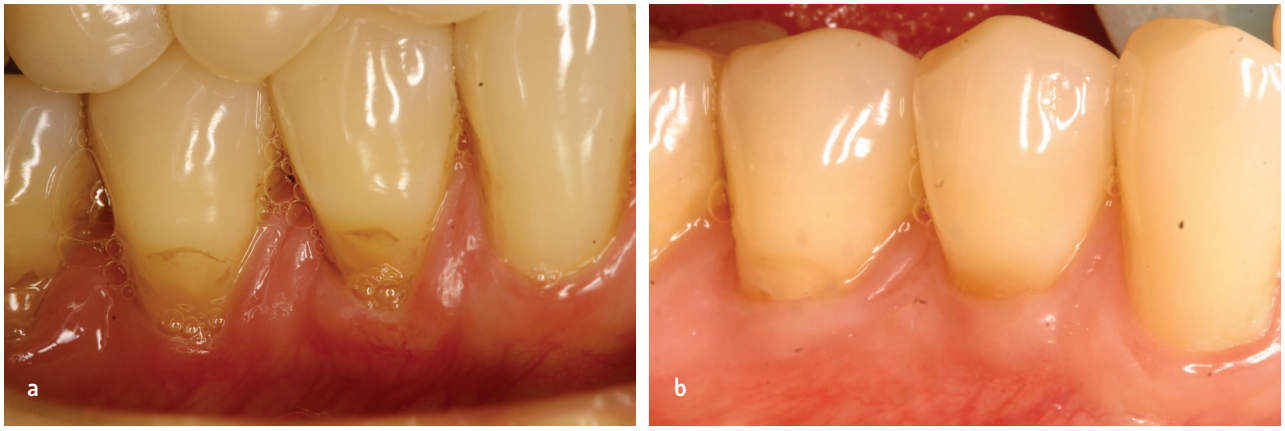


Figures 8a & 8b: Class III on #25, and one year postoperative.

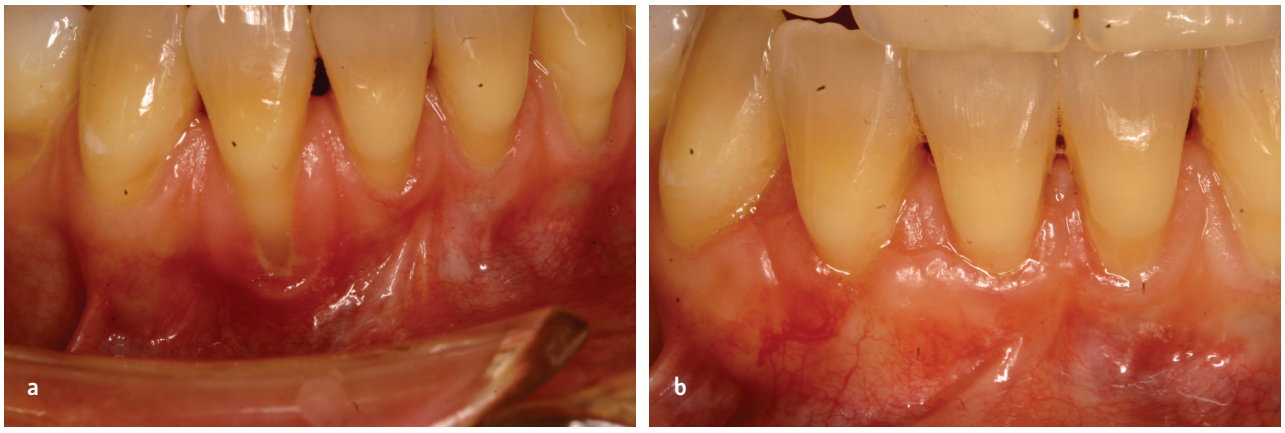
Figures 9a & 9b: Class III on ##22-24 with root prominence (crowns were placed six months after grafting), and two years postoperative.



Figures 10a & 10b: Class II on #28 and #29 (the decay at the margin was excavated followed by soft-tissue grafting), and two years postoperative.

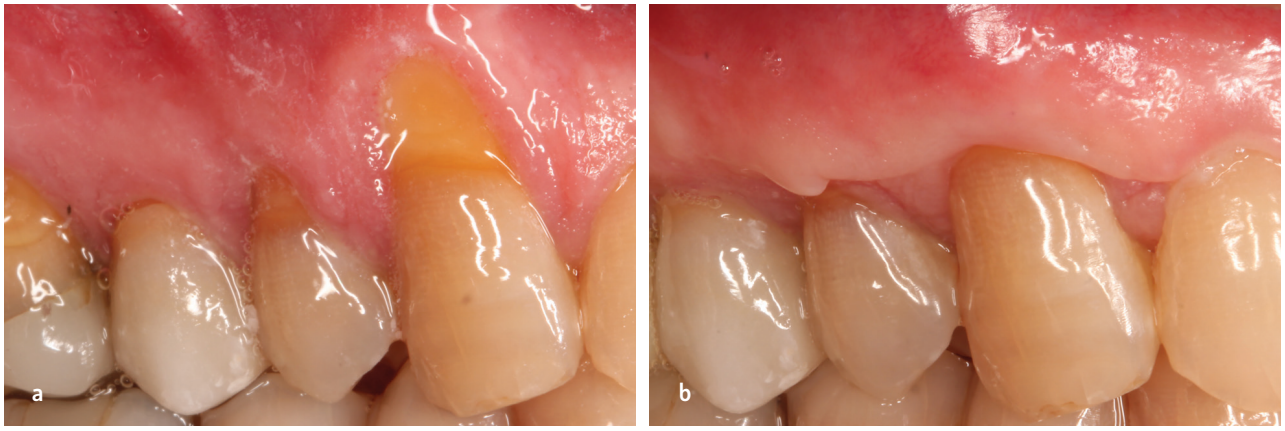


Figures 11a & 11b: Class II on #28 and #29 with root prominence, and five years postoperative.

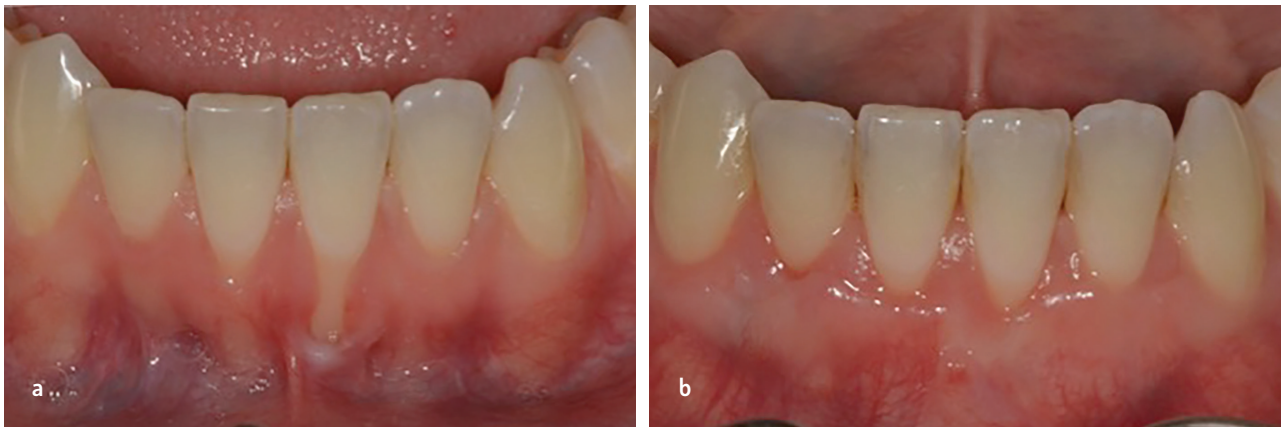


Figures 12a & 12b: Class III on ##23-26, and five years postoperative.

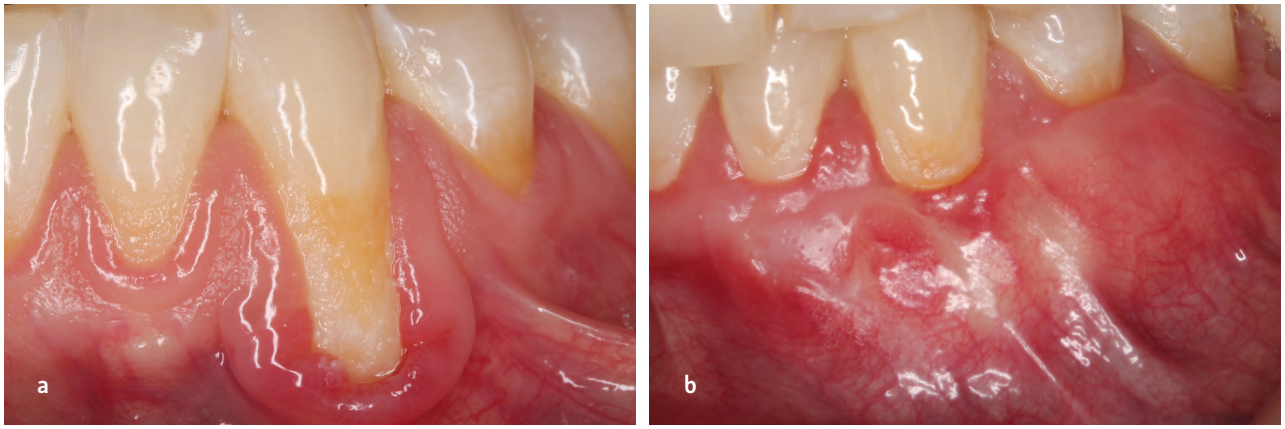
Figures 13a & 13b: Class II on #11 with root prominence and bonding (the bonding was removed and the area grafted), and one year postoperative.



Figures 14a & 14b: Class II on #6, and one year postoperative.



Figures 15a & 15b: Class II on #24, and seven months postoperative.



Figures 16a & 16b: Class II on #22, and six months postoperative.

Figures 17a & 17b: Class II on #22, and six months postoperative.

Figures 18a & 18b: Class II in the area of #24, and four months postoperative.

Case Reports

Case 1

A 28-year-old female presented with an esthetic concern regarding the gingival discrepancy between her maxillary canines (#6 and #11) **(Fig 19)**. The patient had no significant medical history and a dental history of an impacted left maxillary canine (#11). The patient reported that this tooth had been surgically exposed and moved into her arch during orthodontic treatment. She also stated that upon completion of the orthodontic treatment her restorative dentist placed bonding over the tooth root in an effort to decrease the tooth's sensitivity and improve esthetics. Clinical examination revealed no interproximal bone loss, a Class V composite restoration on #11, thin biotype, lack of keratinized attached gingiva, and a prominent root resulting from orthodontic movement.

The above-described technique was selected as a means of connective tissue grafting due to the root prominence at #11 and adjacent alveolar concavities **(Fig 20)**. A full thickness envelope flap from #10 to #12 was created with intrasulcular and papilla slicing incisions. The bonded restoration was removed and the root surface was cleaned and scaled **(Fig 21)**.

Adequate donor connective tissue was harvested from the palate and Puros small-particle MCBA was packed into the adjacent concavities, creating a level recipient bed for the donor tissue **(Fig 22)**. The donor connective tissue was secured in place through the sliced papilla with interrupted sutures (Vicryl 5-0 P3, Ethicon; Blue Ash, OH) **(Fig 23)** and the full thickness flap was coronally advanced and secured with single sling Vicryl sutures **(Fig 24)**. Healing was uneventful; **Figure 25** shows the area three years postoperative. The tissue is healthy and the gingival margin is stable, the amount of root coverage achieved is visible when comparing the before and after images and when noting the gingival margin at #11 relative to the adjacent teeth.

Figure 19: Marked discrepancy in the gingival margin between maxillary canines. Note the existing Class V bonded restoration over the #11 root. The concavity in the alveolus due to the root prominence is visible through the soft tissue on either side of #11.

Figure 20: Class II on #11.

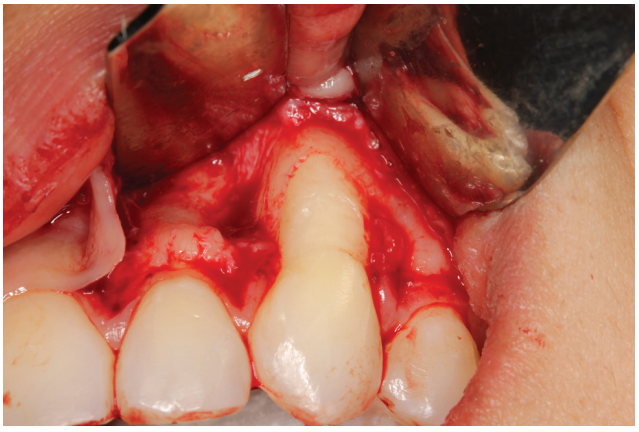


Figure 21: After the bonded restoration at #11 was removed, a full thickness envelope flap spanning ##10-12 was created with intrasulcular and papilla slicing incisions. The concavities adjacent to the prominent root are visible following flap elevation.

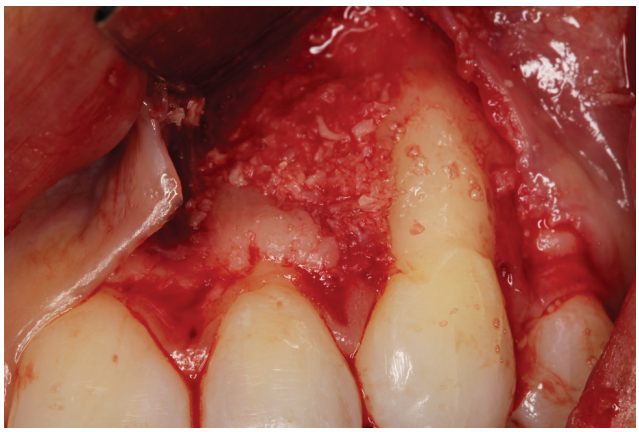


Figure 22: A level recipient bed for the donor tissue was created with MCBA. Note that the bone graft has turned red as it absorbs and wicks the blood from the underlying bone to its surface.

Figure 23: Donor connective tissue was placed over the level recipient bed and sutured into place through the coronal portion of the graft and the sliced papilla.

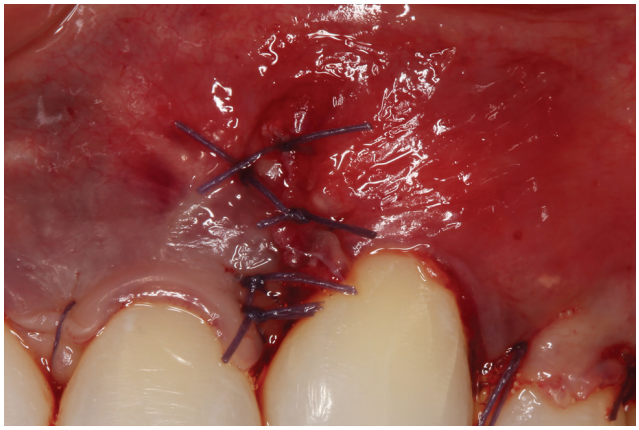


Figure 24: The full thickness flap was coronally advanced and sutured into place, completely covering the grafted tissue.

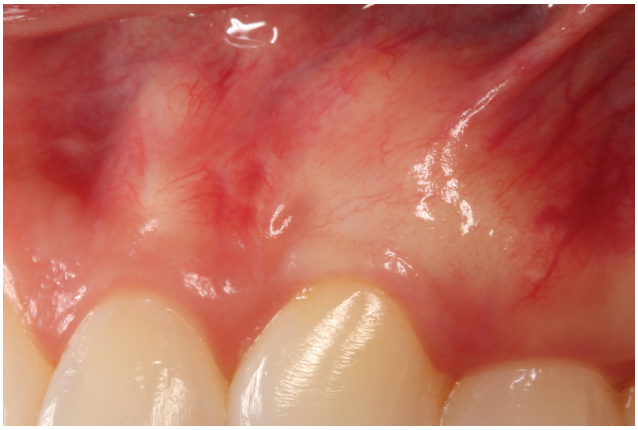


Figure 25: Three years postoperative; note the height of #11 relative to the adjacent teeth.

> "The exposure of the alveolar bone with decortication allows blood from the bone marrow to easily permeate the cortical plate and supply the underside of the grafted tissue."

Case 2

A 31-year-old female presented with a chief complaint of gingival recession in the area of her right mandibular central incisor (#25). She had no significant medical history, and a dental history of orthodontics as a teenager. Clinical and radiographic examination revealed mild interproximal bone loss, gingival recession extending beyond the mucogingival junction of #25, prominent root form in the area of the mandibular anterior, and a thin biotype **(Fig 26)**.

The previously described technique was selected due to the prominent root form seen in **Figure 27**. A full thickness envelope flap was created with intrasulcular and papilla slicing incisions from mandibular canine to canine (##22-27). Once the flap was elevated the prominent roots were visualized outside of the buccal plate and the adjacent concavities in the alveolar bone were noted **(Fig 28)**.

The root surfaces were planed and cleaned and Puros small-particle MCBA was packed into the concavities to create a ramp from the alveolar bone to the root surface as well as a level recipient bed for the donor connective tissue **(Fig 29)**. Adequate donor connective tissue was harvested from the palate and was secured over the recipient bed with interrupted sutures (Vicryl 5.0) through both the graft and the sliced papilla. Once the graft was secured the overlying flap was coronally advanced and secured into place with sling sutures (Vicryl 5-0 P3) reinforced with soft tissue glue (PeriAcryl 90 Oral Tissue Adhesive, GluStich; Delta, BC, Canada) **(Fig 30)**. The patient was seen for regular follow-ups; healing was uneventful and complete root coverage was achieved. A two-year postoperative image is shown in **Figure 31**.

Results and Discussion

It is possible to achieve full coverage of prominent roots using the modified connective tissue grafting technique described above. Postoperative images ranging from four months to five years for a series of 20 cases demonstrating root coverage in areas of recession over prominent roots and malpositioned teeth show the predictability, stability, and results achievable with this surgical technique. Using the clinical cementoenamel junction, height of the adjacent free gingival margin, or height of the gingival margin of the contralateral tooth when indicated, the mean root coverage of the 20 presented cases is 98%. The mean postoperative up time for the 20 cases was 19.5 months and every case achieved full root coverage equal to the height of the adjacent or contralateral gingival margins.

Figure 26: Thin biotype, mild interproximal tissue loss, and recession at #25.

Figure 27: The prominent root form and concavities of the alveolus between #25 and #24 are visible at this angle even through the gingiva.

Figure 28: A full thickness envelope flap was created with intrasulcular and papilla slicing incisions spanning ##22-27. The prominent roots are visible following flap elevation.

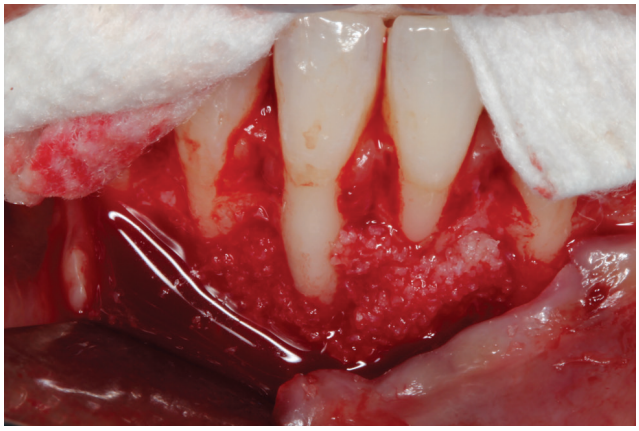


Figure 29: Small-particle MCBA packed into the concavities. Note the graft material turning red from the wicking of the underlying blood supply to the surface.

Figure 30: Adequate donor connective tissue was harvested from the palate and secured over the recipient bed. The overlaying flap was coronally advanced and sutured into place.

Figure 31: Complete and stable root coverage after two years. Gingival margin harmony has been restored and the soft tissue is pink, firm, and healthy, with minimal probing depths.

All of the choices made in the presented surgical procedures were based on wound healing and optimizing the blood supply for the grafted tissue, thus increasing its chance of survival. Increasing the blood supply to the grafted tissue is critical because it is entirely dependent on plasmatic circulation or diffusion of nutrients from the surrounding area during the first few days of healing.[11] Proper stabilization with minimal graft compression through suturing of the graft is also important, as stability is necessary for ingrowth of blood vessels and integration of the donor tissue into the recipient bed.

There are three sources of blood supply to a subepithelial connective tissue graft: the interproximal bone, the PDL, and the supraperiosteal vessels of the overlying flap.[12] A full thickness flap without vertical releasing incisions is used to preserve the supraperiosteal blood vessels and allow the flap to serve as an intact source of blood supply to one side of the underlying graft.[13] The exposure of the alveolar bone with decortication allows blood from the bone marrow to easily permeate the cortical plate and supply the underside of the grafted tissue.[14] Papilla slicing incisions are used to maintain the integrity of the papilla and deepithelialize their surface, allowing for both exposure of the papilla's connective tissue and a stable intact area to suture the graft. Bone graft particulate is placed in the alveolar concavities adjacent to the tooth roots for multiple reasons: to decrease dead space between the alveolus and the donor tissue; to create a level recipient bed; and to wick or absorb blood from the alveolus to the surface of the graft particulate, allowing direct contact between the blood supply of the underlying bone and the donor tissue.

Previous techniques to increase the contact between the interproximal bone and subepithelial grafts in areas of root prominence consisted of mechanical reduction of the root surface. While flattening of a prominent root surface by mechanical means can create more of a level bed for the grafted tissue and increase contact between the graft and alveolar bone, it damages the teeth being treated and the amount of achievable reduction is limited by the pulp chamber. The presented technique of using particulate graft material in the concavities adjacent to prominent roots achieves the goal of increased contact between the graft and blood supply of the alveolar bone without risk to the treated teeth or limitation of pulp chambers.

Summary

Although the authors have had much success using the modified connective tissue grafting technique described here, further long-term studies are needed to compare the results achieved using this technique with conventional means of connective tissue grafting in areas of prominent roots. This technique's capacity to create a stable and predictable esthetic result—and the patient satisfaction that ensues—makes it an excellent addition to any clinician's armamentarium.

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> "Correction of gingival recession in areas of malpositioned teeth and prominent roots, even in cases with little to no interproximal hard or soft tissue loss, can have variable outcomes."

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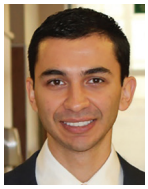

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