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Using tissue graft substitutes in root coverage procedures can avoid complications associated with harvesting an autogenous tissue graft. However, the resulting coverage rate and volume stability are generally lower when using tissue graft substitutes as compared to autogenous tissue grafts. A new volume-stable porcine collagen matrix has recently been introduced for soft tissue thickening around dental implants; however, use of this matrix in recession coverage has not been reported. This case series demonstrates a novel surgical technique and reports clinical outcomes (7 to 12 months) of a minimally invasive root coverage procedure that uses vestibular incision subperiosteal tunnel access in combination with a volume-stable collagen matrix (VISTA-X). Int J Periodontics Restorative Dent 2019;39:e181–e187. doi: 10.11607/prd.4014

Gingival recession defects are a prevalent problem in dental patients. In the United States, approximately 50% of the adults who are 30 years old or older have at least one intraoral site with a gingival recession.¹ Gingival recession defects might result in root sensitivity, root caries, and gingival inflammation. In the esthetic zone, recession defects might be visible and can cause an unesthetic appearance. A study by Ker et al evaluated a discrepancy between the gingival margins of two central incisors. The authors found that a discrepancy greater than 1.5 mm becomes readily identifiable by the patient.² Other authors compared the threshold between the gingival margin positions of a lateral and central incisor.³ If the gingival position of the lateral incisor was greater than 1.2 mm apical or 2.9 mm incisal to that of the central incisor, people would perceive an unesthetic discrepancy. When correcting recession defects, a gingival flap in combination with an autogenous tissue graft generally achieves better clinical outcomes than other techniques.⁴ However, surgical complications associated with harvesting the graft from the donor site, such as wound healing pain, swelling, and bleeding, are usually unsatisfactory.⁵ Recession coverage of multiple adjacent teeth might be additionally challenging because of the limited

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tissue supply from the palate, which means that grafting would require several surgeries. However, an esthetic outcome mostly depends on simultaneous treatment of contiguous recessions. Therefore, current developments aim to overcome these challenges by using graft substitutes such as acellular dermal matrices\textsuperscript{6,7} or xenogeneic collagen matrices\textsuperscript{8} and focus on minimally invasive surgical techniques to reduce the rate of complications and at the same time decrease the surgical procedure time.\textsuperscript{9–11}

A newly developed tissue graft substitute (Fibro-Gide, Geistlich) is a porous, volume-stable porcine collagen matrix (VCMX) specifically designed for soft tissue regeneration. This collagen matrix is made of reconstituted collagen that had been chemically cross-linked to improve its volume stability, and its porous network can support angiogenesis and formation of new connective tissue.\textsuperscript{12} In an in vitro environment, which simulated biologic and mechanical conditions, gingival cells grew inside the collagen matrix.\textsuperscript{13} In preclinical models, this volume-stable collagen matrix demonstrated volumetric stability and histomorphometric structures similar to subepithelial connective tissue grafts indicating its potential to replace subepithelial connective tissue grafts in mucogingival surgeries.\textsuperscript{14,15} VCMX has been successfully used as a substitute for subepithelial connective tissue grafts for soft tissue thickening around dental implants.\textsuperscript{16} The novel modified vestibular incision subperiosteal tunnel access technique with volume-stable collagen matrix (VISTA-X) has been specifically developed to reduce surgical trauma associated with soft tissue augmentation and facilitates the use of VCMX to cover contiguous gingival recession defects. This case series introduces the clinician to the novel technique and is part of a long-term follow-up study.

**VISTA-X Surgical Overview**

The VISTA-X technique could be used to treat single or multiple Miller Class I and II gingival recession defects.\textsuperscript{17} However, since VCMX stabilizes the existing gingival tissue in place at its elevated location, a sufficient amount of vestibule needs to be present to allow for adequate gingival tissue advancement and root coverage around the teeth with recession. Following the administration of local anesthesia, exposed root surfaces are scaled with sharp curettes to reduce root convexity and remove softened tooth structure and undercuts. Using a 15c blade, a small vestibular incision is made through the periosteum close to the mucogingival junction in the nonkeratinized tissue. The location of this incision should be mesial to the tooth/teeth with the gingival recession defect(s). Following the administration of local anesthesia, exposed root surfaces are scaled with sharp curettes to reduce root convexity and remove softened tooth structure and undercuts. Using a 15c blade, a small vestibular incision is made through the periosteum close to the mucogingival junction in the nonkeratinized tissue. The location of this incision should be mesial to the tooth/teeth with the gingival recession defect(s). A full-thickness flap is released through the vestibular access incision using a small mucogingival elevator (Buser #6; Hu-Friedy) (Fig 1a) that is moved underneath the periosteum on top of the bone until a subperiosteal tunnel is created. The tunnel preparation needs to go beyond

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the mucogingival junction and can go through the gingival sulci of the teeth that need to be augmented. In addition, papillae adjacent to the augmented teeth are elevated from their bony surface without any incision on their surfaces. The gingival tissue, including gingival margins and papilla areas of the tooth/teeth with recession defect(s) and the adjacent teeth, has to be completely released and movable to allow a coronal movement of at least 2 mm above the cementoenamel junction (CEJ). The dry VCMX is cut into small pieces (approximately 5 mm × 3 mm). Using a dental plier (college plier #2, Hu-Friedy) or the small mucogingival elevator, the pieces can be easily placed through the access incision underneath the flap to coronally advance and augment the gingiva (Fig 1b). Due to the relatively large volumetric dimension of the small pieces, the gingiva will have an additional thickness of approximately 2 to 3 mm after VCMX placement that will compensate for future volumetric shrinkage. In addition to the midbuccal gingiva, VCMX should also be placed underneath the interproximal tissue to stabilize the papillae. Anchoring 5.0 polypropylene sutures are placed at approximately 2 to 3 mm below the gingival margin of each tooth, to stabilize the gingiva and prevent tissue movement during healing time. The sutures are horizontally passed through the tissue, coronally pulled, and stabilized by flowable composite on the respective teeth (Figs 1c and 1d). The final buccal gingival margin of each tooth should be at least 1 mm above the expected level, which is usually at the CEJ level for Class I and II cases. VCMX should be completely covered by gingiva without any exposure. Postoperatively, ibuprofen (600 mg, 1 tablet, q6h) for 7 days and Peri- dex (0.12%, 1 bottle, ½ oz, bid) for 2 weeks are usually prescribed if the patient is not allergic to these medications. Patients are informed that they should have a soft diet for at least 2 weeks and to avoid pressure over the surgical area for at least 2 months. Sutures are removed 2 weeks after surgery. Patients usually return for follow-up visits at 1 week, 2 weeks, and 1, 2, 3, 6, 9, and 12 months after the procedure.

**Clinical Measurements**

All patients received a comprehensive periodontal examination, and no surgery was performed before the patient demonstrated the following adequate baseline plaque control and minimal gingival inflammation values: probing depth (PD) values of 0.94 ± 0.17 mm at the midbuccal, 1.56 ± 0.17 mm at the mesial, and 1.67 ± 0.25 mm at the distal sides; bleeding on probing (BOP) < 20%; and full-mouth Plaque Index (PI) < 20%. Clinical measurements—gingival recession (GR), measured as the distance from the CEJ to the gingival margin (GM) at the midbuccal aspect of each tooth; PD, measured as the distance from the GM to the bottom of the gingival sulcus; and keratinized gingiva width (KGW), measured as the distance from the mucogingival junction (MGJ) to the GM—were carried out at baseline and at the final follow-up appointments (6 to 12 months after surgery) using a conventional 15 UNC color-coded periodontal probe. Values are presented as mean ± standard deviation (SD). Baseline and follow-up measurements were compared using paired Student t test. Differences were considered statistically significant at \( P < .05 \).

**Case Series**

**Case One**

A 37-year-old systemically healthy man presented with Miller Class I recession defects associated with shallow cervical abrasions in the mandible and complained about hypersensitivity in those areas. He reported a nocturnal bruxism habit and was therefore wearing a mandibular stent at night. The gingival biotype was thin because the periodontal probe could be seen through the tissue. The gingival margins of teeth 33, 34, 35, and 36 (FDI system) were 1 mm, 2 mm, 2 mm, and 1 mm apical to the CEJ, respectively (Fig 2a). The surgical treatment was performed as outlined in the procedural steps (Figs 2b to 2g). Complete root coverage was observed at the 12-month follow-up visit (100%). Previously, the patient had undergone a recession coverage procedure in the maxilla using a connective tissue graft harvested from the palate. He reported that the postoperative discomfort was much less after VISTA-X as compared to the previous procedure because there was no surgical
harvesting of palatal tissue involved. Further, all hypersensitivity in the treated areas was gone.

Case 2
A 28-year-old systemically healthy man presented with Miller Class I gingival recession defects at teeth 22 and 23. The gingival margins of teeth 22 and 23 were 2 and 3 mm apical to the CEJ, respectively, and shallow cervical abrasions were detectable (Fig 3a); his gingival biotype was thick. The patient wanted to treat his recession defects to reduce sensitivity and improve esthetics. The surgical treatment was performed as outlined in the procedural steps (Figs 3a to 3c). During the first week after surgery, the patient felt only minimal postoperative discomfort. Twelve months after the procedure, the gingival recessions at teeth 22 and 23 had improved from 2 and 3 mm to 0 and 0.5 mm, respectively, and root sensitivities were gone (Fig 3d).

Case 3
A 43-year-old woman presented with Miller Class I gingival recession defects of 0.5 and 2 mm at teeth 44 and 45, respectively (Fig 4a). Her gingival biotype was thick. The procedure was performed as outlined and sutures were removed 2 weeks after surgery (Figs 4b and 4c). At the final follow-up, all recession defects were covered and the previously reported root sensitivities were gone (Fig 4d).

The recession defects of all treated sites in all patients were significantly reduced (GR: 1.69 ± 0.8 mm to 0.06 ± 0.18 mm) (P < .0001). The cumulative defect coverage was 96.88% ± 8.84%, and seven out of eight sites showed complete root coverage. KGW did not change between baseline and final follow-up (2.56 ± 0.73 mm to 2.63 ± 0.74 mm) (P = .2500).
Discussion

Tissue graft substitutes, like acellular dermal matrix, xenogeneic collagen matrix, and collagen membrane, have been used in root coverage and soft tissue augmentation procedures. Generally, subepithelial connective tissue grafts (SCTG) are still considered to be the gold standard, given that a gingival flap renders better clinical outcomes than a gingival flap in combination with tissue substitutes. VCMX, a novel tissue graft substitute, could be an additional option in treating gingival recession defects because of its biocompatibility and volume stability. Clinical outcomes of procedures that used VCMX for augmenting soft tissue volume around dental implants have been previously published. VCMX demonstrated volume stability (up to 3 months), and the procedure had a comparable outcome to an SCTG procedure. Based on these results, the authors used VCMX for recession coverage in combination with a modified VISTA approach, which had not been reported before; outcomes comparable to other techniques were observed. The cumulative defect coverage was 96.88% ± 8.84%, with seven out of eight sites showing complete root coverage. Overall, the recession defects were significantly reduced. So far, the technique has been...
performed to treat Miller Class I gingival recession defects (up to 3 mm) in patients who showed a sufficient amount of vestibular depth. Since the gingival margin was not advanced using vertical releasing incisions, coronal advancement of the gingival margin depended primarily on the support of VCMX. The absence of vertical releasing incisions in the recipient site might have reduced pain, bleeding, and swelling; preserved blood supply to the flap; and limited any postoperative scarring, which also resulted in a high patient-satisfaction rate. Further studies will evaluate this procedure in recession defects of more than 3 mm and additional Miller classes.

VCMX is placed underneath the gingiva in a tunnel created through a minimally invasive access incision. Accessing the recession defects apically facilitates VCMX placement because material insertion will not be limited by the space constraints in the gingival margin and papillae areas. Additionally, damage to the gingival margin can be more easily avoided by releasing the flap from an apical site as compared to a coronal site. Clinically, dissecting and advancing a split-thickness flap is a more technique-sensitive and time-consuming procedure than elevating a full-thickness tunnel flap. In addition to an increased risk of flap perforation, partial-thickness flap dissection could excessively thin the overlying flap tissue and cause sloughing, necrosis, and compromised clinical results. The VISTA-X technique was specifically designed to augment gingiva with VCMX. Since the KGW did not appear to have increased after VCMX placement, a minimum 2-mm width might be required to preserve gingival health. Further, a limited KGW might comprise the retention of VCMX, given that mucosa is not as stable as keratinized gingiva. This might explain why complete coverage was not achieved in sites with a limited KGW.

VISTA technique and pinhole surgical technique are both minimally invasive procedures with vestibular access. Compared to the original VISTA technique, the gingival margin is primarily advanced and supported by VCMX in the VISTA-X technique. In addition, the use of multiple small pieces of VCMX in the VISTA-X technique facilitates their placement through the access incision. Further, the pliable pieces can be easily moved around to compensate for an uneven surface and may therefore more easily augment gingival thickness than the use of a one-piece collagen membrane in the VISTA technique. Compared to the pinhole surgical technique, VCMX was used in the VISTA-X technique instead of a regular collagen membrane. Its volume stability and cellular biocompatibility have been demonstrated in preclinical models. Since a regular collagen membrane is generally used to exclude epithelial cells and connective tissue, VCMX may therefore be a better tissue substitute than a collagen membrane in root coverage procedures. Additionally, the anchoring suture technique is not performed as part of the pinhole technique, and is able to secure flap stability during the initial healing phase of the VISTA-X technique.

Conclusions

A minimal traumatic approach and the use of a VCMX are the primary characteristics of the novel VISTA-X technique. This technique allows the simultaneous grafting of multiple contiguous recession defects. It is not very technique-sensitive, postoperative discomfort was limited, and clinical outcomes are promising. A prospective study with a large number of cases will be conducted to further validate the clinical outcomes of the VISTA-X technique.

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References


