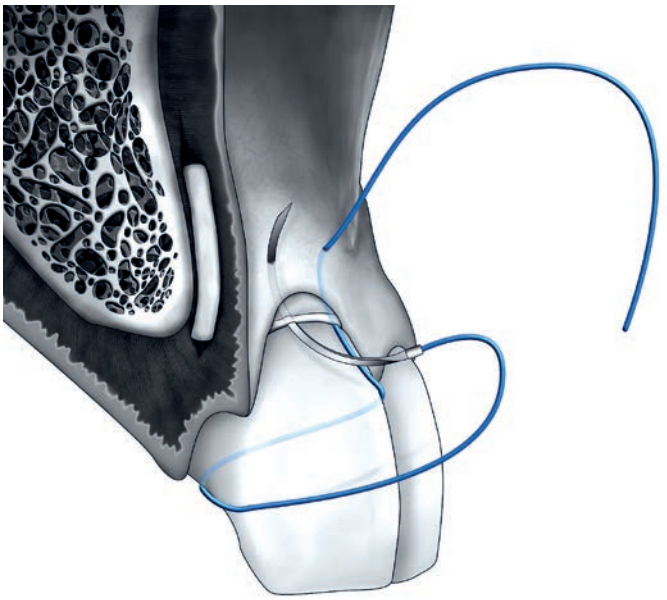

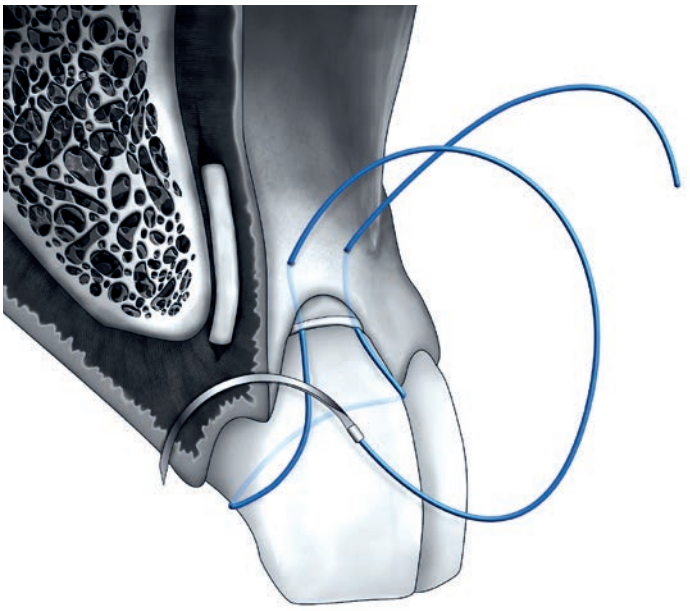

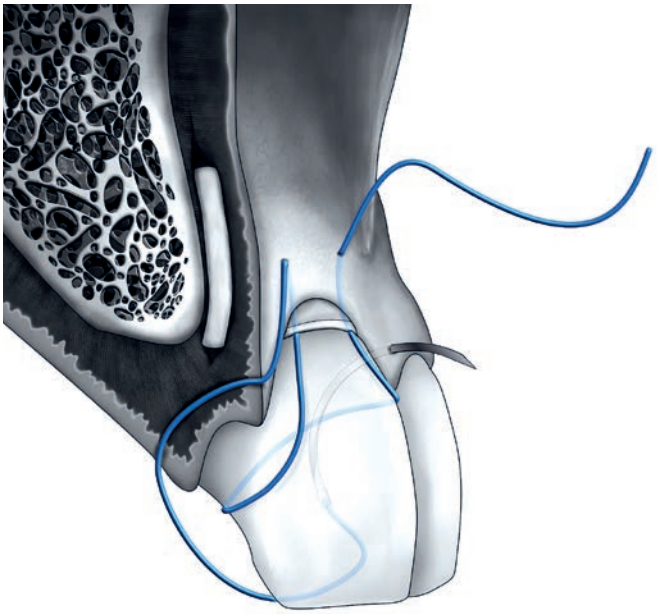

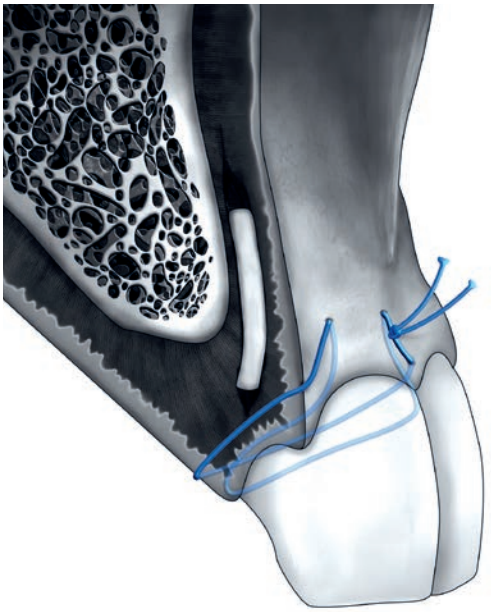

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The Trapezoidal Sling Suture: A Technical Note of a Novel Suturing Technique for Tunneling Flap Procedures

The aim of this report is to describe a new sling suturing method with papillary anchorage that is clinically applicable within the available conventional root-coverage tunneling procedures. Although caution is advised to not increase excessive tension on the fragile papilla tips, as they provide coronal and palatal suspension, the tension used with this method ascertains a firm and stable connection for the entire buccogingival graft complex into the horizontal and vertical dimensions of both single and multiple recession defects. This technical note describes the "trapezoidal sling suture" technique, which allows fixation and stabilization for the graft and flap around both natural teeth and implants. *Int J Periodontics Restorative Dent 2024;44:389–397. doi: 10.11607/prd.6633*

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Root-coverage procedures can currently be divided into two treatment categories: coronally advanced flaps (CAFs) and tunneling procedures. Nevertheless, techniques without a papillary incision (ie tunneling treatments) are postulated to have a beneficial influence on the localized blood supply, overall healing time, and esthetic outcomes, though it puts practitioners to the challenge of finding adequate stabilization without harming the delicate tissue.[1] Providing the correct and necessary suture tension is always a balancing act between proper coronal displacement (including firm stabilization) and its adverse influence on local blood circulation.[1–3]

Whereas the preservation of a sufficient vascular supply depends on initial plasmatic diffusion followed by fast anastomosis to ensure survival,[4–6] early wound stability aims to establish a proper blood clot attachment that is able to withstand the complex oral mechanical circumstances.[7] Adequate suturing is a key step that plays a critical role in wound healing, as it focuses on wound stability and consequently prevents the inevitable soft tissue collapse.[1]

In the recent past, suture methods underwent substantial changes to contribute and even improve this objective of stabilization. Because simple sutures were unable to achieve coronal displacement, the suspended "anchoring" suture

(surrounding a fixed anchor point on teeth and implants) was introduced. Historically, this resulted in a wide variety of suture techniques, all utilizing different points of attachment and sometimes combined with the additional aid of composite resin and/or orthodontic retention buds.[8]

Previous anchor points described within tunneling techniques include: the midcoronal tooth surface, using a horizontal mattress suture with composite resin connection[3]; splinted contact points for the "suspensory sutures" described by Aroca et al[9]; the "vertical double-crossed sutures" from Zuhr et al[10]; and the technique introduced by Ronco and Dard,[11] which combined horizontal and vertical mattress sutures and was later simplified as the "reverse V-Suture" by Chacón Ramirez et al.[12] Contrasting these methods that require composite resin, the single "continuous sling suture" by Allen[13] is supported by palatal root enclosures.

This report aimed to describe a trapezoid-shaped, sling mattress suture technique, utilizing the papilla tip as a novel proposed anchoring point. The goal of the technique is that it can be easily inserted in the already described conventional single and multiple adjacent tunneling procedures around both natural teeth and implants.

Technical Note

General Recommendation

A broad variety of procedural and technical innovations have been described, and the proper execution of the basic soft tissue principles cannot be ignored when expecting a predictable clinical outcome.[14] A correct passive flap preparation aids the latter coronal advancement of the buccogingival complex along the cementoenamel junction (CEJ) without tension. If deemed necessary for biotype thickening, a soft tissue graft or collagen substitute could also be inserted prior to suturing[11] (Figs 1a to 1c).

The presented clinical cases were performed by two well-experienced clinicians (V.S. and B.C.) under magnified vision using an overall minimal invasive approach, including an operative microscope (OPMI pico, f170, Zeiss). A consent form agreeing to participate in this study was signed by all three patients prior to surgery.

Trapezoidal Sling Suture

This section provides a comprehensive technical step-by-step overview and explanation of the novel trapezoidal sling suturing technique.

The sutures penetrate the keratinized tissue in the midfacial area, approximately 2 mm apical to the free gingival margin and lateral to the recession apex. Attention should be given to the proper alignment of the coronal part of the underlying graft substitute to the gingival margin while passing the needle through the combination of tissues (Fig 1d).

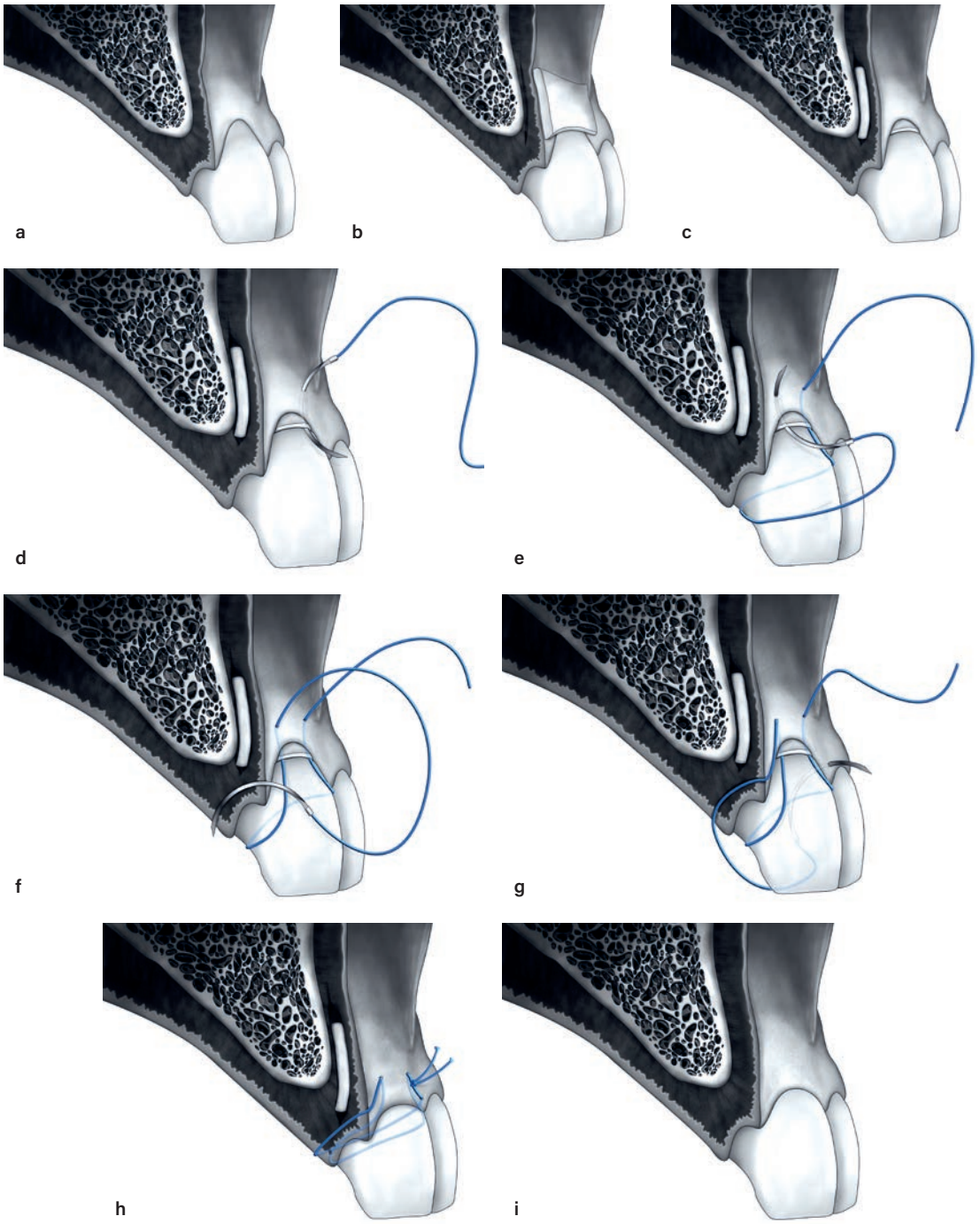
After carefully retracting the needle, it slides under the contact point, towards the palatal region of the affected root. Then, by passing the cervical aspect of the palatal root, it is brought back to the vestibular side at the other interproximal space. By pushing the needle first through the dental embrasure, only minimal trauma and displacement is expected.

The second time the suture penetrates the combined graft-flap complex at the same height, it is from the inside, at the contralateral side of the recession defect apex (Fig 1e).

The third soft issue insert is positioned approximately 1 mm under the most coronal papilla tip. A curved needle (involving 3/8 of a circle, > 13 mm long) should allow the practitioner to safely overpass the interproximal space without harming the delicate vestibular end of the papilla tip (oral aspect). With a longer needle length and a cautious needle rotation, the needle exit is expected to reappear on the oral surface at the same height, around 1 mm from the papilla tip, on the oral surface (Fig 1f).

After a subsequent passive passage (ie, sling) around the palatal supragingival aspect of the root, the papilla tip is penetrated from the oral side towards the contralateral vestibular side. This last needle act returns the suture to the buccal side, near the root line angle of the first insertion (Fig 1g).

During this last procedural step, one single knot is tied at the vestibular side. By maintaining suture tension without increasing force, the total gingival-graft complex has the possibility for further coronal advancement. Consequently, after following the described insertions, both legs of a trapezoid figure appear (Fig 1h). During healing, the coronally advanced gingival margin repositions and realigns with the CEJ (Fig 1i).



▲ **Fig 1** Step-by-step procedure of the trapezoidal sling suture. *(a)* Single Miller Class I recession defect on a central incisor. *(b)* A soft tissue graft or graft substitute is customized to meet the appropriate defect measurements. *(c)* After passive flap preparation, which aids later tension-free coronal advancement of the buccogingival complex along the CEJ, the soft tissue graft or collagen substitute is inserted prior to suturing. *(d)* The sutures first penetrate the keratinized tissue approximately 2 mm apical to the free gingival margin, lateral to the apex of the recession defect. *(e)* After the palatal passage, the suture then penetrates the combined graft-flap complex at the contralateral side of the defect apex, from the inside and poking out. *(f)* The third soft tissue insertion is about 1 mm below the most coronal papilla tip. The needle exit is expected to reappear on the oral surface at the same height, around 1 mm from the papilla tip. *(g)* After a subsequent passive passage (ie, sling) around the cervical aspect of the palatal root, a second papilla tip penetration from the oral side toward the vestibular side is performed at the contralateral side. *(h)* One single knot is tied at the vestibular side. After following the described insertions, the two vertical legs of a trapezoidal figure appear. *(i)* During healing after suture removal, the coronally advanced gingival margin repositions and realigns with the CEJ.

▲ **Fig 2** Clinical case 1: Multiple adjacent recessions around natural teeth. *(a)* Clinical presentation of two shallow Miller Class I defects on the maxillary right canine and first premolar. *(b)* CTG placed in the correct surgical position. *(c)* Immediate postoperative presentation. *(d)* Clinical view 2 weeks after surgery. *(e)* Clinical view at 6 months, after soft tissue maturation.

Clinical Cases

Clinical Case 1: Multiple Adjacent Recessions Around Natural Teeth

A patient presented with two shallow Miller Class I defects on the maxillary right canine and first premolar (Fig 2a). Minor tooth sensitivity and impaired esthetics were reported as the two main reasons for surgical intervention. A split-full-split preparation with adequate release was incorporated into the surgical protocol and performed using microsurgical blades and knives. An autologous graft was inserted buccally into the opened dentin-flap interface (Fig 2b). Before the trapezoidal sling suture was performed, an accessory positioning suture was placed at the distal papillary zone to simplify the connective tissue graft (CTG) placement in the desired position (Fig 2c). Favorable healing and maturation were observed at 2 weeks (Fig 2d) and 6 months (Fig 2e) postsurgery.

▲ **Fig 3** Clinical case 2: Single immediate implant placement. *(a)* An external resorption defect was present at the vestibular root aspect of the maxillary right central incisor. The localized deformity is characterized by inflammation around the gingival collar and a slight zenith asymmetry (around 2 mm) relative to the contralateral tooth. *(b)* The tooth was extracted, and an implant was immediately placed with consequent resin-cemented temporary crown preparation. *(c)* A CTG was harvested from the lateral posterior palate, shown here in the correct surgical position. *(d)* After a minimally invasive tunnel approach, the resin-cemented temporary crown was brought into position to seal the alveolus. *(e and f)* Clinical views at 2 weeks and 3 months postsurgery, respectively. *(g)* Final clinical outcome after esthetic diastema closure.

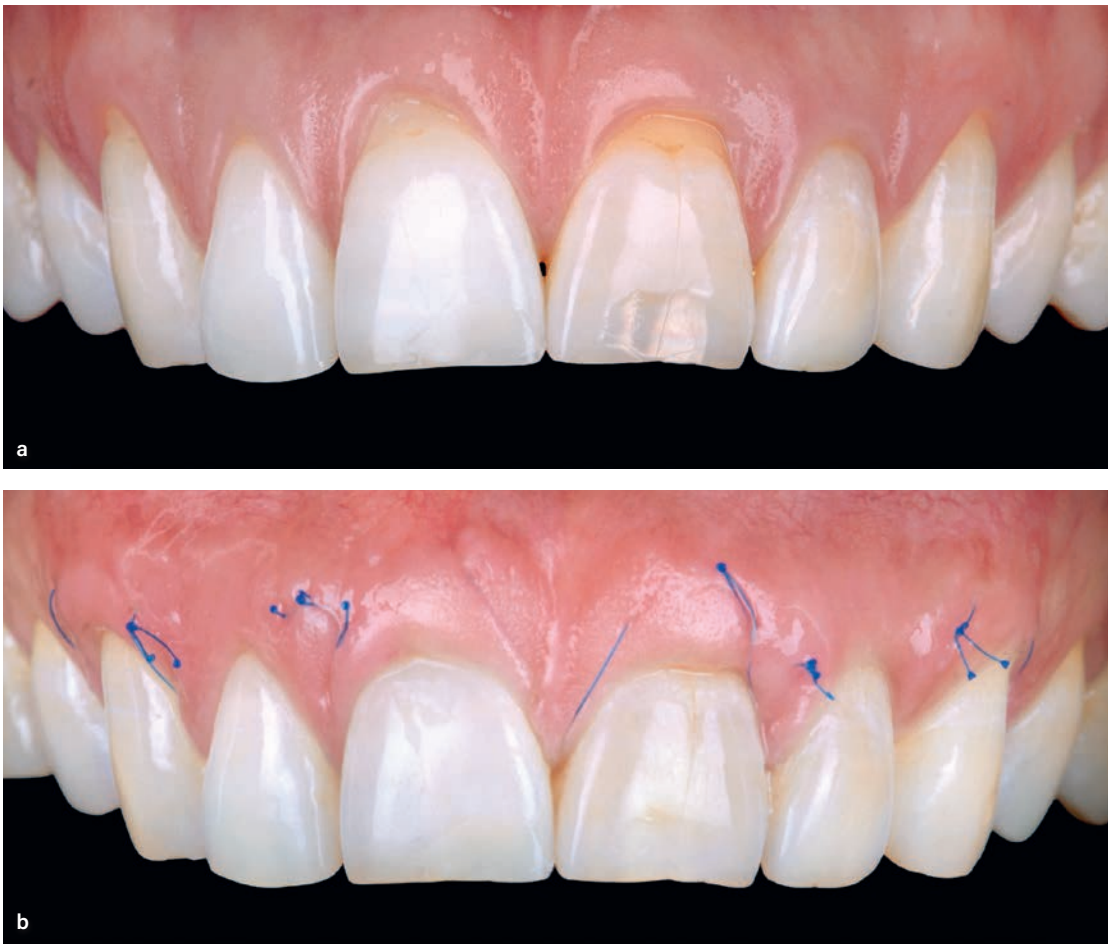
Clinical Case 2: Single Immediate Implant Placement

A 35-year-old woman presented with an external resorption defect on the vestibular root aspect of the maxillary right central incisor, assumed to be caused by a childhood bike trauma. The localized deformity was characterized by inflammation around the gingival collar and a slight zenith asymmetry of around 2 mm relative to the contralateral tooth (Fig 3a). After a thorough clinical and radiologic examination, the tooth was considered irrational to treat and had to be extracted (Fig 3b).

After immediate implant placement (V3, MIS Implants), a temporary crown was cemented to seal the alveolus, and a CTG was harvested from the lateral posterior palate region to meet the patient's esthetic demands[1,2] (Fig 3c).

A minimally invasive tunnel approach was performed to obtain adequate release and coronal advancement of the entire buccogingival-graft complex. Thereafter, a buccal pouch was prepared for insertion and two additional mattress sutures were implemented to create space and correctly align the underlying graft with the gingival flap. The trapezoidal sling suture completed the recession treatment by moving the gingival outline in the recommended position (1 mm overcompensation)[1] (Fig 3d).

At 2 weeks postoperative, an eventful healing was obtained with relocation of the gingival collar towards a balanced soft tissue display (Fig 3e). Figures 3f and 3g show the clinical outcome at 3 months and after esthetic diastema closure, respectively.



▲ **Figs 4a and 4b** Clinical case 3: Multiple recessions around natural teeth. *(a)* The patient presented with four Miller Class I defects on the maxillary central incisors and canines. *(b)* Each involved tooth, with (central incisors) or without (canines) the additional CTG application, received a trapezoidal sling suture. →

Clinical Case 3: Multiple Recessions Around Natural Teeth

A 42-year-old man presented with four Miller Class I defects at the maxillary central incisors and canines, complaining of increased marginal plaque accumulation and impaired esthetic harmony. It was decided to augment the gingival thickness, cover the denuded roots, and realign the gingival collars (Fig 4a).

Following the proposed tunneling protocol, a CTG was harvested from the lateral posterior palate and inserted at the central incisors, surrounding both teeth to compensate for a lack of localized gingival thickness. Each involved tooth, with or without the additional CTG application, received a trapezoidal sling suture (Fig 4b).

At 10 days posttreatment, uneventful healing was reported, complete recession coverage was seen, and the site had impeccable soft tissue harmony. Sutures were removed at 2 weeks (Fig 4c). At 3 months postoperative, a slight recession persisted at the two incisors. These minimal, strictly vestibular recessions could be attributed to preoperatively untreated invagination defects (Fig 4d).

Discussion

Suturing is a key prerequisite for an optimal surgical outcome in periodontal plastic surgery, as it provides stabilization while preserving an adequate blood supply and soft tissue integrity.[15]

▲ **Figs 4c and 4d** *(c and d)* Clinical views at suture removal (2 weeks) and 3 months postsurgery, respectively.

Nowadays, a variety of suturing methods is available, each focusing on essential improvements, such as displacement and stability, minimally invasive character, time reduction, facilitated handling properties (such as knotting), economic persuasions, and high patient compliance.

Nevertheless, adequate stabilization within CAF methods is easily provided by applying single interrupted and sling sutures, whereas the tunneling procedures require more specified techniques, each relying on different immobile anchoring points, to promote close adaptation and fixation of the entire buccogingival-papillary complex.

In 2010, Allen described the "subpapillary continuous sling suture" method, which utilized one single suture to penetrate the midfacial area, approximately 3 mm apical to the gingival margin.[13] In comparison to Allen's technique, the novel trapezoidal sling suture is less prone to deforming the scalloped gingival outline, as the sutures surpass the interproximal area through the papilla instead of underneath. Further, the trapezoidal sling sutures reach a higher initial displacement by taking advantage of the coronal position of the papilla tip, instead of the lower position of the palatal root enclosures. Nevertheless, a possible disadvantage of using the papilla as an anchoring point is the relative papilla height, whereas it is expected that a gingival overcompensation of 2 mm (in terms of midfacial coronal displacement) is impossible to achieve, especially when avoiding excessive tension on this delicate, poorly vascularized papillary tissue. This latter issue can partially be avoided by providing an evenly distributed and controlled suture compression.[16]

The suturing methods supported by contact points[9–12] or the midfacial coronal surface[3] fixed anchoring surfaces, combined with an initial occurring healing edema, present a relative chance of laceration complications. In contrary, the trapezoidal sling suture only requires the papillary area that allows coronal displacement of the entire buccogingival-graft complex as a whole. Therefore, this technique can easily be included in immediate implant cases, or cases where adequate composite adhesion is impossible to achieve, while prohibiting unwanted internal micromotions that could jeopardize the essential intimate contact.

Besides the coronal displacement and stabilization from the coronal papillary suspension, this novel technique also accommodates a distinct horizontal traction, enhancing the close contact between the possible graft, gingival flap, and the hard buccal outline. This results in greater intimate contact of the entire buccogingival-papilla complex and directly reduces unwanted micromotion induced by mechanical oral disruption and pooling of blood due to limited available blood clot space. This bilateral horizontal component also aggregates to the recreation of a natural undulated scalloped anatomy as a favorable consequence of the entire soft tissue complex merging with the underlying root prominence.[17,18]

With the possibility of implementing small locational adjustments for the insertions (closer or wider positioning), the trapezoidal sling suture is suitable for a wide range of defects. The vestibular insertion could compensate for a slight defect asymmetry by lateral positioning of the design, following the subadjacent apical borders of the recession rather than the long root axis.

Another advantageous feature is the need for only one suture and one knot that comprises both the interdental sides and the midfacial region surrounding the defect. Given that sutures are seen as a traumatic event, limiting the total number of knots makes this technique minimally invasive, time-efficient, and highly tolerated by patients.[10,15]

This novel described trapezoidal sling technique can easily be implemented in conventional tunneling procedures and has the possibility to ascertain a firm and stable connection for the entire buccogingival-papilla complex by using the papilla tip as a stable anchorage point.

Conclusions

Within its domain of application, this trapezoidal sling suture technique seems to be a valid technique for improving certain notable surgical requirements, such as graft and flap fixation plus stabilization. Future research, including some long-term clinical studies, is necessary to validate this novel technique and compare it with previously described conventional suture methods following a tunneling approach.

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