

“V-reverse” suturing technique for tunnel soft tissue graft and flap stabilization: Technique
Illustration

Gerardo José Chacón Ramírez *, Lorenzo Tavelli †, Shayan Barootchi †, Hom-Lay Wang †

* Private Practice, Medellin, Colombia

† Department of Periodontics & Oral Medicine, University of Michigan School of Dentistry, Ann Arbor, MI, USA

Correspondence to:

Hom-Lay Wang, DDS, MSD, PhD

Department of Periodontics and Oral Medicine, University of Michigan School of Dentistry

1011 North University Avenue

Ann Arbor, Michigan 48109-1078, USA.

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Author contribution

G. Chacon Ramirez: Design of the study, surgical intervention, acquisition and interpretation of data, manuscript preparation and the initial draft, final reviewal of the work; accountable for all aspects of the work. **L. Tavelli:** Design of the study, manuscript preparation, final reviewal of the work; accountable for all aspects of the work. **S. Barootchi:** Conception and design of the study, manuscript preparation, final reviewal of the work; accountable for all aspects of the work. **H-L Wang:** Design of the study; critical review of the draft and contribution to the writing of the manuscript; Final approval of the version to be published and accountable to the accuracy or integrity of the work.

ABSTRACT

Introduction. In periodontal and peri-implant plastic procedures, proper stabilization of the graft and the flap plays a crucial role in the outcomes. While the coronally advanced flap allows for a better access with the possibility of suturing the graft to the periosteum and the de-epithelialized papillae, there is little evidence regarding what is the best approach in stabilizing the graft and the flap when performing the tunnel techniques (TUN). The purpose of this technical note is to describe a new suturing technique “V-reverse” for stabilization the graft and the flap during a TUN procedure.

Case presentation. The V-reverse suturing technique was used to enhance the stabilization of the graft and the flap during root coverage procedures, papilla augmentation and immediate implant placement. Other advantages of this technique include reduced flap and graft micromotion, simple, easy and fast procedure, with high patient compliance.

Conclusion. The present article describes three main clinical scenarios in which V-reverse suturing technique is used to stabilize TUN + connective tissue graft for root coverage procedures, papilla augmentation and immediate implant placement.

Background

Periodontal plastic surgery is aimed at improving esthetics for patients with gingival recessions or mucogingival defects ^{1, 2}. The autogenous connective tissue graft (CTG) has shown to be superior than other materials in terms of mean and complete root coverage, gain in keratinized tissue width (KTW), and esthetic outcomes ¹⁻³. Specifically, CTG with coronally advanced flap (CAF) has shown to be the most effective treatment for correcting single and multiple gingival recessions ⁴. Among the factors that can influence the outcomes of CAF + CTG, proper stabilization of the graft and the flap has been suggested to play a crucial role ⁵.

Techniques without papillary incision have been advocated to enhance blood supply, promote better healing and improve esthetic outcomes ⁶⁻⁸. Nevertheless, soft tissue graft stabilization with these minimal invasive approaches has presented a challenge for clinicians. Some authors have suggested using sling sutures for stabilization (of both the flap and the graft), while others have employed composite resins for anchorage of sutures, and preventing the collapse of the soft tissues during the early healing period ⁸⁻¹⁰.

On the other hand, there is no doubt that soft tissue grafting procedures have become popular around dental implants, including the treatment of peri-implant soft tissue dehiscences, augmenting keratinized mucosal width and/or thickness ^{1, 11}. Also, in these scenarios, the stabilization of the graft and the flap plays a crucial role for the final clinical outcomes. While CAF allows for a better access with the possibility of suturing the CTG to the periosteum and to the de-epithelialized papillae ^{11, 12}, there is little evidence regarding what is the best approach in stabilizing the CTG and the flap when performing tunnel techniques (TUN).

Therefore, the aim of the present manuscript was to describe a new suturing technique “V-reverse” for stabilizing the flap and the graft during a TUN procedure.

Clinical presentation

Non-smoking patients with esthetic concerns due to single or multiple gingival recessions or patients with thin peri-implant soft tissue phenotypes undergoing immediate implant placement were included in this technique illustration. All surgeries were performed by a single clinician (G.C.R) with more than 15 years of experience in a private practice. Verbal and written informed consents were obtained from patients before the procedure.

Case management

The “V-reverse” suturing technique involved the insertion of the CTG (or a graft substitute) and its anchorage to the flap as described by Aroca and coworkers¹⁰ (Fig. 1A). Composite stops were placed at contact points prior to suturing¹⁰. The V-reverse suture starts from the palatal site (Fig. 1B). The needle passes underneath the contact point (with composite stops) from the palatal to buccal aspect and then engages the graft and the flap in the midfacial area approximately 3 mm apical to the free gingival margin (but always in keratinized tissue) (Fig. 1C). The needle is then passed to the palatal side, under the contact point (Fig. 1D), turned around the splinted composite (once, and without pinching the soft tissue) and a knot is placed and tightened over the composite (Fig. 1E-F). Similarly, another suture is performed starting from the other contact point of the teeth (the mesial or the distal). Then, the needle pinches the soft tissue in the midfacial area of the tooth approximately 2-3 mm away, in a mesio-distal direction, from the previous suture. After having tightened the knot, the suture resembles a reverse V shape (Fig. 1G-H). Clinicians should check the stability of the graft and the midfacial area of the flap. It is very important to not have any micromotion in this area, as it is to not have an excessive tension. This issue (micromotion/tension) can be easily avoided with an adequate flap preparation and tension release. Figure 2 shows two cases of isolated maxillary gingival recessions treated with TUN + CTG in which the V-reverse suture was used to stabilize the graft and the flap, promoting a fast and uneventful healing. The V-reverse suture can also be performed for multiple gingival recessions. In that case, each tooth with recession will have a V-reverse suture (with two separate knots at the level of the splinted contact points) and the contact point(s) between two teeth with recession will have two knots as well.

In the case presented with papilla deficiency between the two central maxillary incisors, a minimally invasive tunnel flap preparation with CTG harvested from the tuberosity was inserted and stabilized to the flap (Fig. 3A-C). A V-reverse suturing technique was performed at the mesial aspect of the right and left incisors with approximately 4-5 mm distances at the buccal aspect. Note that if possible, the needle has always to engage keratinized tissue on the facial aspect, with the entrance point approximately 3 mm apical to the free gingival margin. The suture was only left in place for 5-7 days. Additionally, a gingivoplasty procedure was performed after 5 months to improve the soft tissue contour (Fig. 3D).

Figures 4 and 5 show single or multiple immediate implant placement where a CTG harvested from the palate was inserted and sutured between the flap and buccal bone with the V-reverse suturing

technique. Note that this suturing approach requires temporary crown and splinted contact points (Fig. 4 C-D and Fig. 5B). The V-reverse suturing technique further stabilizes the graft and applies gentle pressure to the flap in a coronal direction.

Clinical Outcomes

Sutures were removed at 5 days after an uneventful healing with minimal post-operative discomfort. Figure 2C shows complete root coverage of the isolated gingival recession after 6 months. Papilla augmentation with V-reverse suturing technique achieved satisfactory outcomes after 6-month (figure 3E). Soft tissue augmentation during immediate implant placement with immediate temporalization resulted in a satisfactory soft tissue volume gain and texture (figures 4 and 5). All patients reported minimal morbidity during the first two post-operative weeks as well as high satisfaction of the treatment.

Discussion

The success of periodontal plastic surgery is influenced by several factors. Among them, an important factor is facilitating a faster and uneventful wound healing by preserving the blood supply of the surgical site and providing adequate stability with sutures⁷. Indeed, sutures allow for proper closure and stabilization of the graft and the flap in the desired position¹³. The stabilization of the graft and the flap also promote the close adaptation of the soft tissues and the graft against the root surface, which results in the protection of the blood clot leading to improved healing capacities^{5, 13}. While sling and interrupted sutures are the most commonly performed techniques for CAF, several suturing approaches have been described for TUN. In order to prevent the collapse of the soft tissues, Aroca et al.¹⁰ and Zühr et al.⁷ have suggested the use of composite stops that are placed at the contact points. Suspensory sutures¹⁰ or double-crossed sutures⁷ around the composite stops allow for coronal advancement of the TUN flaps. However, a possible drawback of these approaches is the fact that the stabilization of the graft and the flap mainly occurs in the interproximal areas, while it is not uncommon to have some flap micro-movement in the midfacial area, which may compromise the final root coverage outcomes.

Allen described a subpapillary continuous sling suture for stabilizing both the graft and the tunnel flap with a single suture⁹. In this approach, the needle penetrates the flap and the graft 3 mm apical to the soft tissue margin in the midfacial area⁹, similar to the presented V-reverse suturing technique. Other techniques for the stabilization of the flap in the midfacial area - rather than the interproximal - include the use of an orthodontic button positioned on the facial side of the teeth or a horizontal

mattress suture with the knot positioned at the midcoronal level of the tooth and bonded with composite ⁸. Nevertheless, patients may complain of having visible sutures in the center of the tooth during the first two weeks. The V-reverse suturing technique enhances the stabilization of the graft and the flap in the midfacial region which is likely the most crucial area that should be firm for achieving complete root coverage ⁵. It has also been shown that during the initial phases of the healing, the presence of blood clot is not sufficient for maintaining the flap against the root surface ¹⁴. Therefore, it is reasonable to assume that stabilizing the graft and the flap in the midfacial area, rather than in the interproximal sites alone, may promote a faster and better healing ^{5, 8}.

Readers should be aware that the V-reverse suturing technique can only be performed when the flap is tension-free. Suturing the flap with residual tension may impair neo-vascularization with an increased risk of flap dehiscence or necrosis. Before suturing, the flap should be able to passively reach a level 1-2 mm coronal to the cemento-enamel junction of the tooth (or to the crown margin of the implant). Advantages of this new V-reverse suture technique include but are not limited to: improving stability of the graft and the flap in the midfacial area; reducing flap and graft micromotion; simple, easy and fast application, and high patient compliance. However, it has to be mentioned that this approach may not be applicable at sites with a thin gingival phenotype or lack of keratinized mucosa since it may cause flap dehiscence. Nevertheless, TUN is typically not recommended in these situations ¹⁵.

Conclusions

The V-reverse suturing technique can be a valid technique for improving graft and flap stability following the tunnel approach. More studies are necessary to validate the effect of V-reverse suturing technique during tunnel procedure and to compare this technique with other conventional approaches.

Summary

<p>Why are these cases new information?</p>	<ul style="list-style-type: none"> • This technique illustration presents a novel minimally invasive suture technique that can enhance flap and graft stability • Reduced flap and graft micromotion, simple, easy and fast procedure, with high patient compliance can be achieved with this method
<p>What are the keys to</p>	<ul style="list-style-type: none"> • Minimally invasive flap preparation and graft insertion

success management of these case?	<ul style="list-style-type: none">• Tension-free suturing• Case selection: a minimal band of keratinized tissue (2-3 mm) is recommended
What are the primary limitations to success of these cases?	<ul style="list-style-type: none">• Tunnel technique and V-reverse suturing technique are not recommended in the absence of keratinized mucosa• Clinical studies with long-term outcomes of this approach are needed

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REFERENCES

1. Zucchelli G, Tavelli L, McGuire MK, et al. Autogenous soft tissue grafting for periodontal and peri-implant plastic surgical reconstruction. *J Periodontol* 2020;91:9-16.
2. Tavelli L, Barootchi S, Cairo F, Rasperini G, Shedden K, Wang HL. The Effect of Time on Root Coverage Outcomes: A Network Meta-analysis. *J Dent Res* 2019;98:1195-1203.
3. Barootchi S, Tavelli L, Zucchelli G, Giannobile WV, Wang HL. The effect of gingival phenotype conversion therapy on natural teeth: a network meta-analysis. *J Periodontol* 2020. doi: 10.1002/JPER.19-0715
4. Zucchelli G, Tavelli L, Barootchi S, et al. The influence of tooth location on the outcomes of multiple adjacent gingival recessions treated with coronally advanced flap: A multicenter re-analysis study. *J Periodontol* 2019;90:1244-1251.
5. Tavelli L, Barootchi S, Ravida A, Suarez-Lopez Del Amo F, Rasperini G, Wang HL. Influence of suturing technique on marginal flap stability following coronally advanced flap: a cadaver study. *Clin Oral Investiq* 2019;23:1641-1651.
6. Tavelli L, Barootchi S, Nguyen TVN, Tattan M, Ravida A, Wang HL. Efficacy of tunnel technique in the treatment of localized and multiple gingival recessions: A systematic review and meta-analysis. *J Periodontol* 2018;89:1075-1090.
7. Zuhr O, Rebele SF, Cheung SL, Hurzeler MB, Research Group on Oral Soft Tissue B, Wound H. Surgery without papilla incision: tunneling flap procedures in plastic periodontal and implant surgery. *Periodontol 2000* 2018;77:123-149.
8. Zadeh HH. Minimally invasive treatment of maxillary anterior gingival recession defects by vestibular incision subperiosteal tunnel access and platelet-derived growth factor BB. *Int J Periodontics Restorative Dent* 2011;31:653-660.
9. Allen EP. Subpapillary continuous sling suturing method for soft tissue grafting with the tunneling technique. *Int J Periodontics Restorative Dent* 2010;30:479-485.
10. Aroca S, Keglevich T, Nikolidakis D, et al. Treatment of class III multiple gingival recessions: a randomized-clinical trial. *J Clin Periodontol* 2010;37:88-97.

11. Zucchelli G, Tavelli L, Stefanini M, et al. Classification of facial peri-implant soft tissue dehiscence/deficiencies at single implant sites in the esthetic zone. *J Periodontol* 2019;90:1116-1124.
12. Stefanini M, Marzadori M, Tavelli L, Bellone P, Zucchelli G. Peri-implant Papillae Reconstruction at an Esthetically Failing Implant. *Int J Periodontics Restorative Dent* 2020;40:213-222.
13. Burkhardt R, Lang NP. Influence of suturing on wound healing. *Periodontol 2000* 2015;68:270-281.
14. Hiatt WH, Stallard RE, Butler ED, Badgett B. Repair following mucoperiosteal flap surgery with full gingival retention. *J Periodontol* 1968;39:11-16.
15. Rasperini G, Codari M, Limiroli E, Acunzo R, Tavelli L, Levickiene AZ. Graftless Tunnel Technique for the Treatment of Multiple Gingival Recessions in Sites with Thick or Very Thick Biotype: A Prospective Case Series. *Int J Periodontics Restorative Dent* 2019;39:e203-e210.

Figures Legend

Figure 1. Drawing illustrating the “V-reverse” suturing technique for soft tissue augmentation with tunnel technique + soft tissue graft. A) Soft tissue graft inserted in the tunnel flap and secured to the flap at the level of the distal aspect of the two central incisors. B) The V-reverse suture starts in the palatal aspect passing below the splinted contact point. C) The needle engages the graft and the flap (from inside to outside) approximately 3 mm apical to the soft tissue margin in the mid-facial area. D) The needle passes to the palatal side under the contact point. E-F) The needle turns one round around the splinted composite (without pinching the soft tissue) and then the knot is performed and tightened over the composite. G-H) Another similar suture is performed starting from the other contact point of the tooth (the mesial one in this case). At the end, the sutures form a V-reverse shape. In this case, the same procedure is repeated also on the other incisor. Each tooth has two independent sutures and knots.

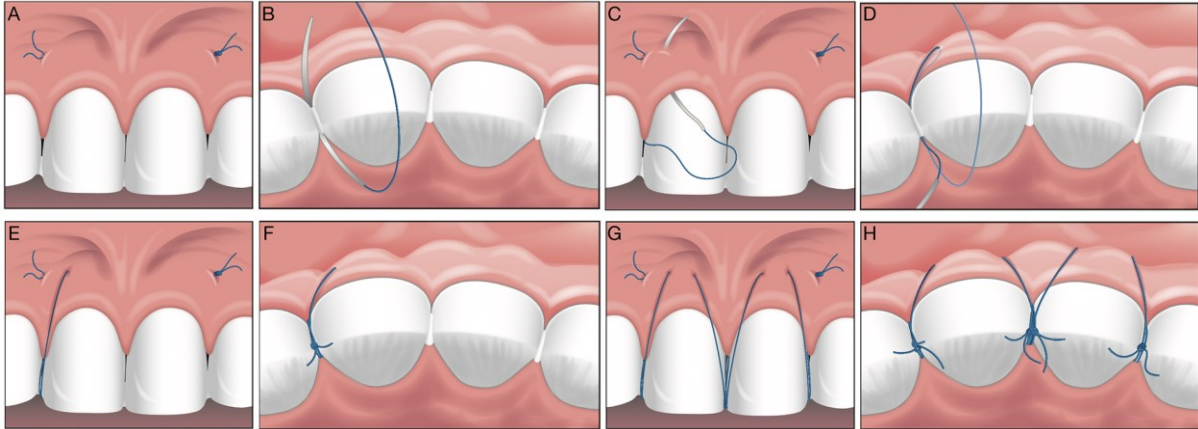


Figure 2 (Exemplary figure). V-reverse suturing technique for the treatment of single recessions in the maxilla. A) maxillary canine with a shallow gingival recession; B) Tunnel technique with connective tissue graft was performed, together with the V-reverse suturing technique for stabilizing the graft and the flap. C) 6-month outcomes.

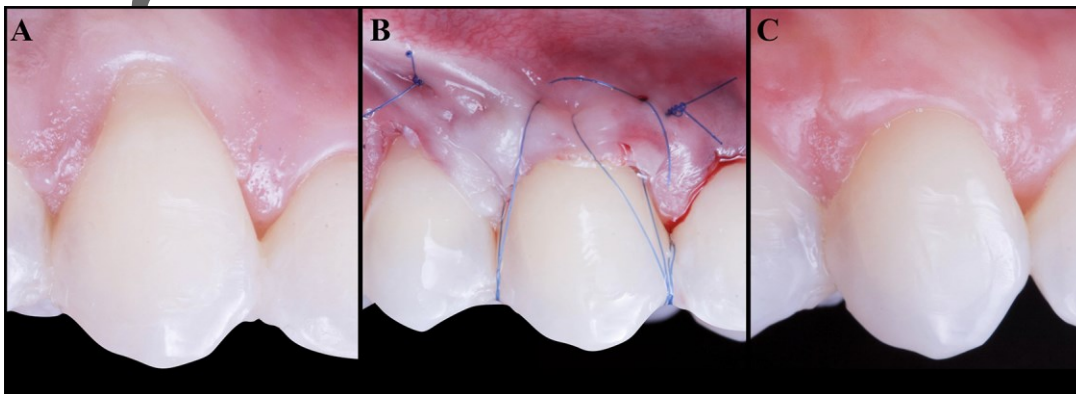


Figure 3 (Exemplary figure). Papilla augmentation with tunnel approach, connective tissue graft and V-reverse suturing technique. A) Baseline. B) Connective tissue graft harvested from the maxillary tuberosity. C) The graft is inserted into the tunnel flap and stabilized with simple sutures and with the V-reverse suturing technique. D) Gingivoplasty was performed after 4 months. E) 7-month outcomes.

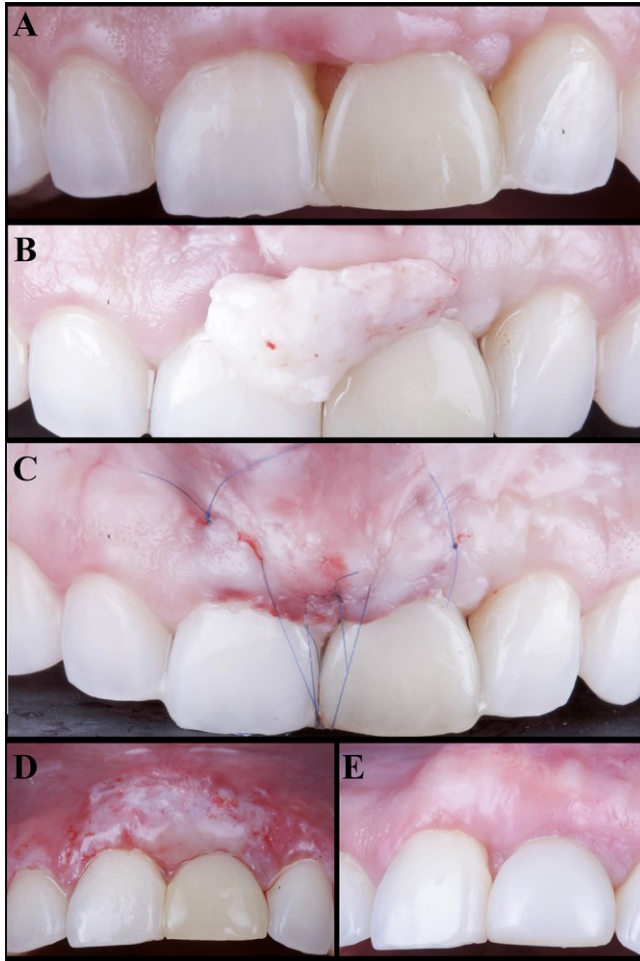


Figure 4. V-reverse suturing technique for preventing the collapse of the soft tissue margin following immediate implant placement and immediate provisionalization. A-B) After the placement of an immediate implant, a connective tissue graft was positioned in the buccal aspect. In addition, xenogeneic bone graft was used to fill the gap between the implant and the buccal bone. C-D) V-reverse suturing technique using the splinted contact point between the natural adjacent teeth and the provisional crown. E-G) Healing at 5 days when the sutures were removed. H) 6-month outcomes

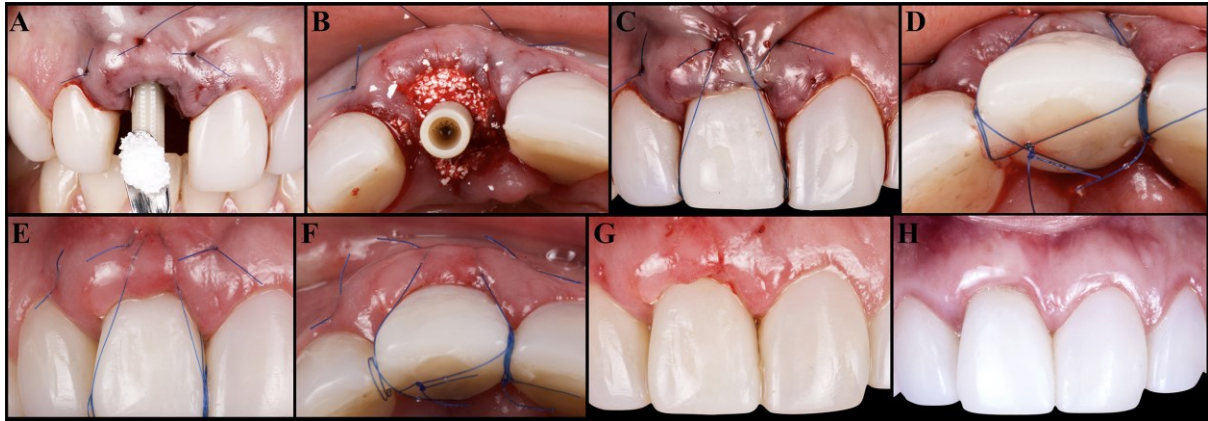
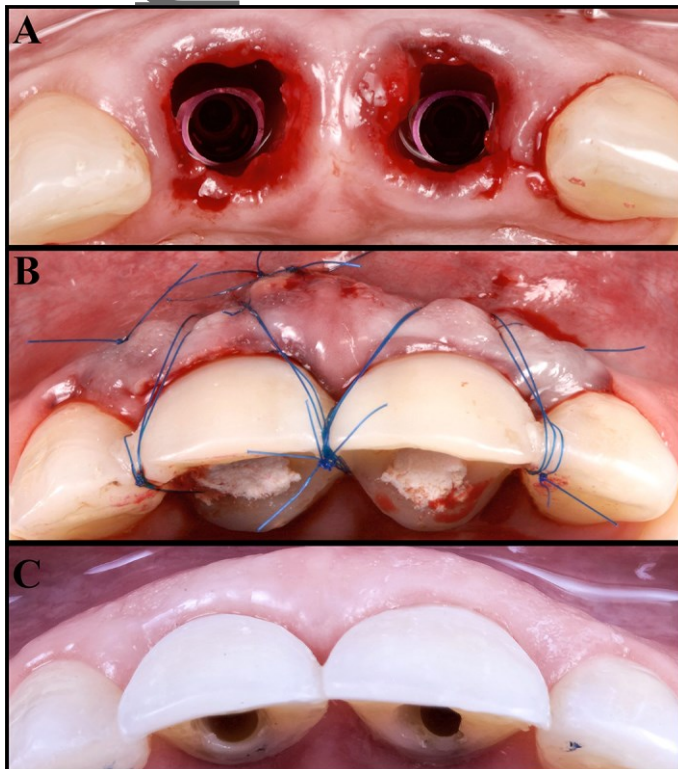


Figure 5. V-reverse suturing technique for preventing the collapsing of the soft tissue following immediate implant placement and immediate temporalization of the two maxillary central incisors. A) Immediate implant placed in the cingulum position. B) V-reverse suturing technique for stabilizing the connective tissue graft and the tunnel flap. C) 6-month outcomes showing the soft tissue facial contour increased with the soft tissue augmentation



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