Comparative Analysis of VISTA and minimum invasive intrasulcular Tunnelling Technique Using Tuberosity Graft Versus VISTA and intrasulcular Tunnelling Combined with Palatal Subepithelial Connective Tissue Grafts in multiple gingival recession coverage with Split-Mouth Design: An Original Investigation

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ABSTRACT

Objective: To compare the clinical outcomes of Vestibular Incision Subperiosteal Tunnel Access (VISTA) tunnelling technique using tuberosity grafts versus VISTA tunnelling combined with palatal SCTG graft in the treatment of Miller's class I and class II gingival recession in a patient with maxillary anterior left and right region using a split-mouth design.

Materials and Methods: A 23-year-old male patient presenting with bilateral Miller's Class I and Class II gingival recession defects in the maxillary anterior left and right region was enrolled. Recession sites were randomly assigned to two groups: VISTA tunnelling using tuberosity graft (test group) and VISTA tunnelling combined with palatal SCTG graft (control group). Clinical parameters, including gingival recession depth (GRD), clinical attachment level (CAL), and keratinized tissue width (KTW), were measured at baseline and 6 months postoperatively. Patient-reported outcomes, such as pain and esthetic satisfaction, were assessed using a visual analogue scale (VAS).

Results: Both techniques showed significant improvements in CAL, RD, and KTW. However, the tuberosity graft group demonstrated reduced postoperative pain and donor site morbidity, while the palatal graft group achieved slightly superior root coverage percentages.

Conclusion: Both methods are effective for multiple recession coverage. The choice of technique may depend on clinical requirements and patient preferences, particularly regarding donor site morbidity and aesthetic outcomes.

Keywords: Gingival recession, keratinized gingiva, etiology, VISTA technique.

INTRODUCTION

Gingival recession is a common periodontal issue that leads to root exposure, hypersensitivity, and aesthetic concerns. Various surgical approaches aim to restore soft tissue coverage and enhance periodontal health. Among these, the VISTA technique has gained popularity due to its minimally invasive nature and ability to accommodate different grafting materials.[1]

Gingival recession (GR) arises from various causes, which can be broadly classified into two categories: (a) predisposing factors and (b) precipitating factors. Developmental issues such as tooth malposition, a thin gingival biotype, insufficient keratinized gingiva, or frenal pull are considered predisposing factors, as they create conditions that increase the likelihood of GR. On the other hand, precipitating factors include external influences like aggressive tooth brushing, smoking, plaque-induced inflammation, or certain dental procedures (e.g., specific orthodontic movements or subgingival restorations), which directly contribute to the occurrence of GR.[2]

PATHOGENESIS

Etiology Gingival Recession due to Zarda Placement,

1. Chemical Irritation

Zarda contains nicotine, slaked lime, areca nut, and carcinogens like nitrosamines, which have cytotoxic effects on gingival fibroblasts and epithelial cells.

The alkaline pH and oxidative stress induce tissue necrosis, impair healing, and degrade the extracellular matrix.

This leads to apoptosis of gingival keratinocytes and breakdown of collagen fibers, initiating gingival shrinkage and attachment loss.

2. Mechanical Trauma

Repeated placement and pressure from zarda in the maxillary labial vestibule causes direct mechanical injury to the marginal gingiva.

The abrasive texture of the tobacco leaves, lime particles, and areca nut fragments causes epithelial abrasion, ulceration, and chronic trauma—particularly in the labial surfaces of maxillary anteriors.

3. Inflammatory Response

Zarda triggers chronic inflammation, attracting neutrophils, macrophages, and lymphocytes.

These immune cells release MMPs (matrix metall oproteinases) and cytokines (e.g., IL-1β, TNF-α), which lead to breakdown of connective tissue and loss of periodontal attachment.

4. Vascular Effects

Nicotine causes vasoconstriction, reducing gingival blood flow and impairing normal wound healing and oxygenation of the tissues.

This hypoxia further delays repair and increases susceptibility to breakdown.

5. Plaque Retention and Poor Oral Hygiene

Zarda-stained areas often accumulate plaque and calculus, which exacerbate inflammatory periodontal destruction, especially if oral hygiene is neglected.

Clinical Features

- Recession typically appears on the labial gingiva of maxillary anterior teeth.
- Gingival thinning and apical migration
- Discoloration or keratinization
- Root surface exposure and sensitivity
- Localised attachment loss without deep pockets

A gingival cuff is frequently found in the distal region of the maxilla's most posterior tooth. In some cases, this cuff creates a pseudopocket that may require a gingivectomy. The firm, keratinized tissue in this area serves as a reliable source for soft tissue grafting. Being located away from major blood vessels, it poses minimal hemostasis issues. Hirsch et al. introduced root coverage using a subepithelial connective tissue graft from the tuberosity area during a pocket reduction procedure, yielding predictable and esthetically pleasing results. Alternatively, tissue from the tuberosity can be harvested via gingivectomy, avoiding the need for a mucoperiosteal flap and reducing postoperative pain compared to palatal grafts. The harvested tissue is easily adaptable to recipient sites after epithelial removal, without requiring suturing of the donor site.

The tuberosity graft offers advantages such as increased soft tissue volume and proximity to the surgical site. Conversely, palatal SCTG combined with tunneling provides robust tissue integration and aesthetic benefits. This split-mouth study compares these two techniques to evaluate their clinical efficacy and patient outcomes.[3,4]

CLINICAL FINDINGS

A 23-year-old male (ASA 1) patient presenting with bilateral Miller's Class I and class II gingival recession defects reported to the department of Periodontology , Bhojia Dental College and Hospital, Bhudd,Baddi, H.P. Patient used to place zarda under labial vestibule in relation to right and left maxillary lateral incisors & canines but has quit tobacco since 3 years, patient now compliants of esthetic and senstivity issue in maxillary right and left upper teeth. class I gingival recession seen in relation to 12, 14 & 22and class II gingival recession seen in in relation to 13 and 23. Surgery was planned four weeks after oral prophylaxis. Written informed consent was obtained prior to the procedure. Routine hematological investigations were conducted and found to be within normal physiological limits.

Clinical Parameters

A UNC-15 probe was utilized to measure the clinical attachment level (CAL), Gingival Recession Depth (GRD), Keratinized Tissue Width (KTW) and postoperative satisfactory factor.The following parameters were assessed at baseline and 6 months

postoperatively:

1. **Gingival Recession Depth (GRD):** Distance from the CEJ to the gingival margin.
2. **Clinical Attachment Level (CAL):** Distance from the CEJ to the base of the pocket.
3. **Keratinized Tissue Width (KTW):** Distance from the gingival margin to the mucogingival junction.
4. Patient-reported outcomes, such as pain and esthetic satisfaction, were assessed using a visual analogue scale (VAS).

Instuments used

- Woodsons's Periosteal elevator
- Molt's periosteal elevator
- Cumin scaler
- Universal and Gracey currettes
- B.P. Handle
- 15, 15c & 12 No. blades
- Castroviejo scissor
- Adson forcep
- Needle holder
- UNC-15 Probe
- Braided silk non absorbable sutures # 4 & #5

Surgical Protocol

In an aseptic condition local anaesthesia 2% lignocaine with 1:80,000 adrenaline was given. The patient face swabbed with povidone-iodine 0.5% for avoiding any infection during surgical procedure. Patient instructed to rinse his mouths with a mouthwash (0.12% of chlorhexidine di-gluconate) for a minute prior to the surgery.

A. VISTA with Tuberosity Graft (Test Group):

- Initial vestibular incision was made in vestibular zone full thickness flap reflected via this incision, and a vestibular tunnel was created in the vestibular region connecting interdental area of first premolar # 14& 15 to interdental area i.r.t # 11& #12.
- A minimum invasive intrasulcular incision was given in sulcus of #13, #12 tooth and a split thickness flap was reflected but sparing of interdental papilla (till the base of papilla) and an intra-sulcular tunnel created around teeth # 14-12 through sulcus.
- Both intrasulcular and vestibular tunnels were connected meticulously which allows coronal movement of gingival margins at least 2 mm coronal to CEJ.
- Tuberosity graft was harvested from the right maxillary tuberosity region, de-epithelized carefully and inserted into the tunnel with help of hook sutures and lasso sutures.
- PRF membrane was also made and inserted inside tunnel to accelerate healing.
- To maintain the gingival margin's position and prevent apical migration during the initial healing phase, 4.0 braided silk non-absorbable sutures were secured to the facial surface using coronally anchored sutures, around lingual buttons.
- Lingual buttons were placed 2 mm coronal to the coronally advanced gingival margin. Around lingual buttons suture knots were reinforced by using a small amount of flowable composite resin. (fig.13)
- The vertical incision was subsequently closed by multiple interrupted sutures using 5.0 braided silk non-absorbable sutures.
- Non eugenol based surgical dressing was placed over the surgical site for at least 3 weeks.
- After 3 weeks sutures were removed.

TEST SITE (RIGHT SIDE) - VISTA with Intrasulcular Tunnelling using Tuberosity graft

Fig. No. 1: Preop. view of the gingival recession

Fig. No.2: Gingival recession in upper 13 & 12

Fig. No.3: Measuring inter-proximal bone loss by UNC-15

Fig. No.4: Depicting class I & II Miller's Gingival recession

Fig. No.5: Intrasulcular incision made

Fig.No.6: Vestibular access incision in right Maxillary vestibule

Fig. No.7: Intrasulcular tunnel preparation

Fig. No.8: Subperiosteal tunnel preparation

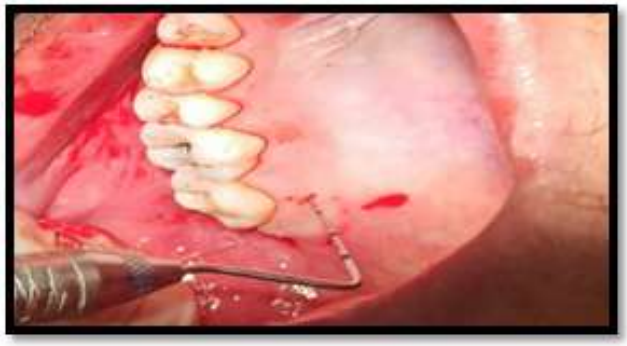


Fig. No.9:Marking for procurement of tuberosity graft

Fig.No.10: Incision for harvesting tuberosity graft

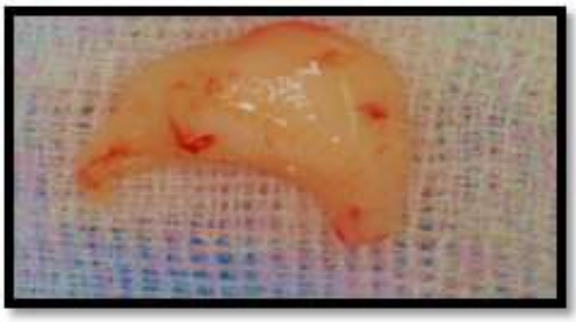


Fig. No.11: Tuberosity graft

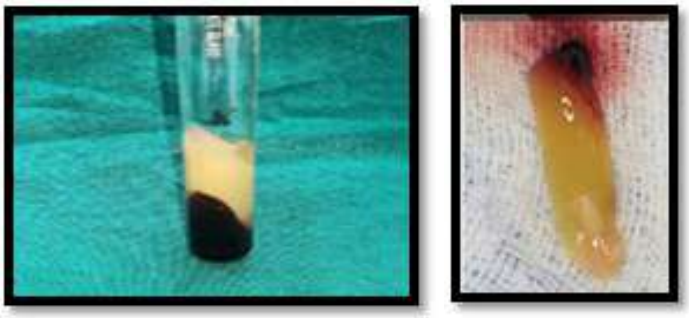


Fig. No.12: PRF prepared and inserted inside tunnel

Fig.No.13: Coronal anchored suture around orthodontic buttons

Fig. No.14: One week post suturing accidently breaking of suture

Fig. No.15: 21 days after suture removal

Fig. No.16: Follow up after 3 months

Fig. No.17: Follow up six months

B. VISTA with Intrasulcular Tunneling and Palatal SCTG Graft (Control Group):

1. Initial vestibular incision was made in vestibular zone full thickness flap reflected via this incision, and a vestibular tunnel was created in the vestibular region connecting interdental area of first premolar # 24& 25 to interdental area i.r.t # 21& #22.
2. A minimum invasive intrasulcular incision was given in sulcus of #23, #22 tooth and a split thickness flap was reflected but sparing of interdental papilla (till the base of papilla) and an intra-sulcular tunnel created around teeth # 24- #21 through sulcus.
3. Both intrasulcular and vestibular tunnels were connected meticulously which allows coronal movement of gingival margins at least 2 mm coronal to CEJ.
4. A subepithelial connective tissue graft was harvested from the palate with trapdoor technique and placed on a wet gauze till bleeding from palatal site was controlled and sponge is sutured at donor site with cross mattress and sling sutures.
5. Subepithelial connective tissue graft was placed within the tunnel with help of lasso and hook sutures.
6. PRF membrane was also made and inserted inside tunnel through vestibular incisions to accelerate healing.
7. To maintain the gingival margin's position and prevent apical relapse during the healing phase, 4.0 braided silk non-absorbable sutures were secured using coronally anchored suture technique and the knots were stabilized by using a small amount of flowable composite resin on the facial surface of each tooth.
8. The vertical incision was subsequently closed by multiple interrupted sutures using 5.0 braided silk non-absorbable sutures.
9. Non eugenol based surgical dressing was placed over the surgical site for at least 3 weeks.
10. After 3 weeks sutures were removed.

CONTROL SITE (LEFT SIDE) - VISTA with Tunnelling and SCTG Graft.

Fig. No.18: Control site -Preop. view of the gingival recession

Fig. 19: Control site- Gingival recession in upper 22 & 23

Fig. No.20: SECT Procurement by trapdoor technique

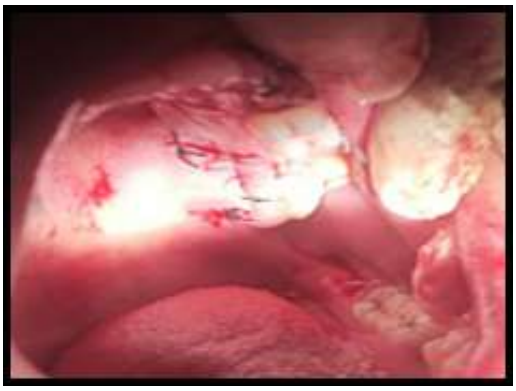


Fig.21: At donor site suturing done

Fig.No.22: SECT graft Harvested

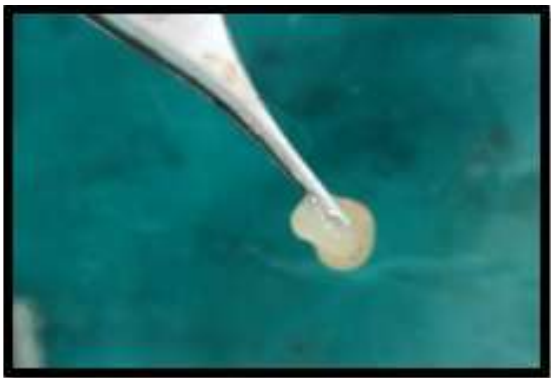


Fig. No.23: PRF membrane made and inserted inside tunnel

Fig. No.24: Coronally anchored suture in process

Fig. No. 25: Coronally anchored sutures with composite stops

Fig. No.26: 2 week follow up in between change of dressing

Fig. No. 27: 4 week follow up

Fig. No. 28: Follow up after 6 months

Postoperative Care

- Antibiotics (amoxicillin 500 mg, three times daily for 7 days) and analgesics (Ibuprofen 400mg + Paracetamol 325 mg three times daily for 5 days were prescribed.
- Patients were advised to refrain from brushing the surgical site for 4 weeks.
- Patients were instructed to report any complications, such as dressing displacement or excessive bleeding, immediately.
- At the 3-week follow-up visit, periodontal dressings were carefully removed, and the area was irrigated with saline.
- Sutures at the donor site were removed after one week.
- Sutures at recipient site were removed after 3 weeks.
- Starting from the 4th week post-surgery, patients were guided to resume gentle brushing at the surgical site using a soft-bristled toothbrush.
- Chlorhexidine mouthwash (0.12%) was recommended twice daily for 4 weeks
- Patients were instructed to avoid mechanical brushing in the surgical area for 4 weeks.

Patient-Reported Outcomes

- Pain and esthetic satisfaction were recorded using a VAS ranging from 0 (no pain/not satisfied) to 10 (severe pain/high satisfaction).

Calculations: TEST GROUP

Fig. No.29: Pre- op Miller's class II in #13.

Fig. 30: 21 days post op.

Fig. No.31: 6 months post op.

Fig. No.32: Pre- op Miller's class I in #12

Fig. No.33: 21 days post op.

Fig.No.34: 6 months post op.

Right canine	**Baseline**	**3 months**	**6 months**
CAL (mm)	9 mm	5mm	4 mm
KTW ↑(mm)	2 mm	10 mm	9.1mm
GRD ↓(mm)	7 mm	0 mm	1 mm
Patient satisfaction	0	8	7
Right lateral incisor	**Baseline**	**3 months**	**6 months**
CAL (mm)	3mm	2mm	1mm
KTW ↑(mm)	5mm	7mm	6 mm

Calculations: CONTROL GROUP

Fig No.35: Pre-op. Miller's class II in #23

Fig. No.36: 21 days post op.

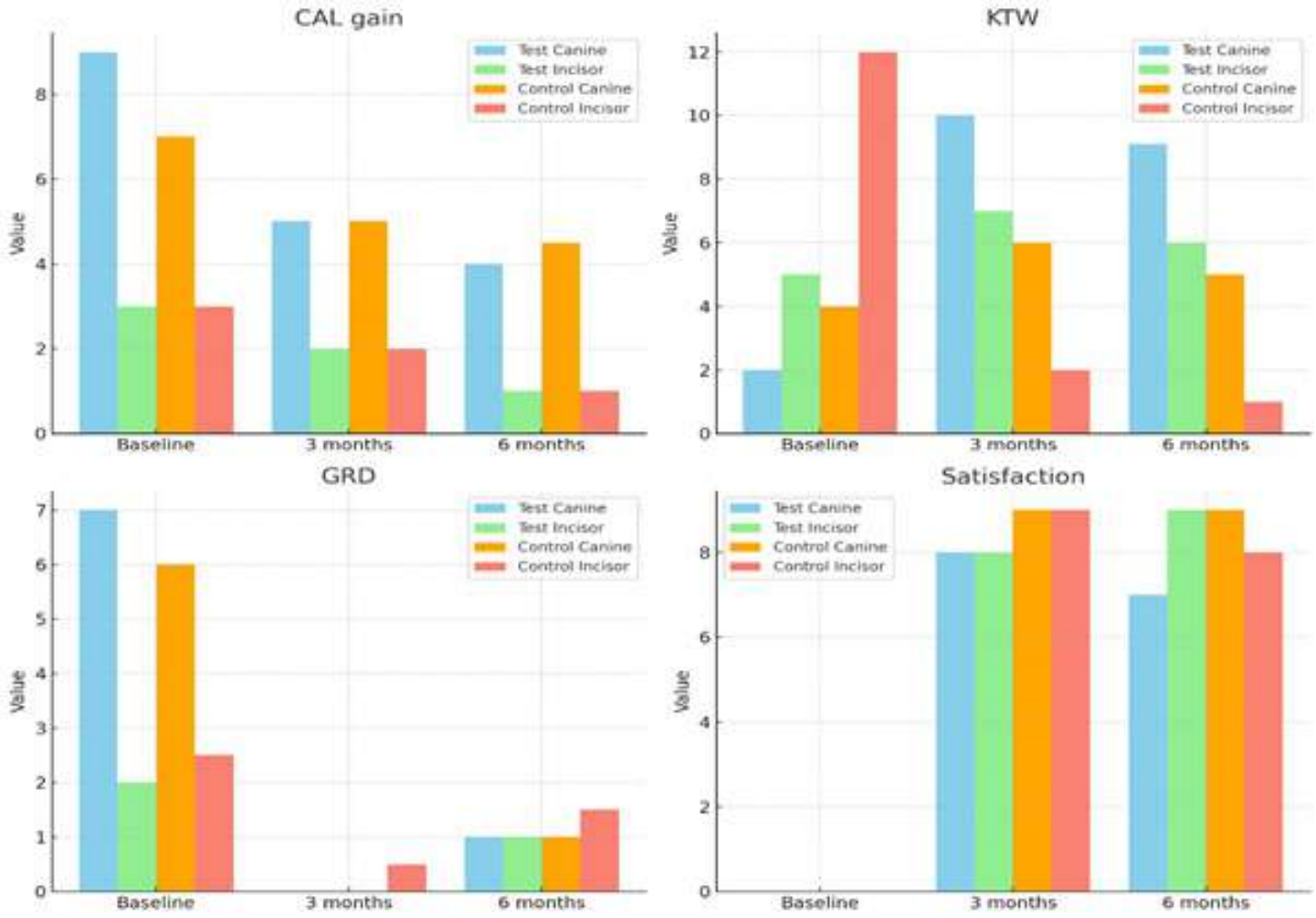
Fig: 37: 6 months post op.

Fig. No 38: Pre-op. Miller's class II in #22.

Fig. 39: 21 days post op.

Fig. 40: 6 months post op.

LEFT canine	**Baseline**	**3 months**	**6 months**
CAL (mm)	4 mm	6 mm	5 mm
KTW ↑(mm)	4 mm	6 mm	5 mm
GRD ↓(mm)	6 mm	0 mm	1 mm
Patient satisfaction	0	9	9
Left lateral incisor	**Baseline**	**3 months**	**6 months**
CAL (mm)	3mm	2mm	1mm
KTW ↑(mm)	12mm	2mm	1 mm
GRD ↓(mm)	2.5	2mm	1mm
Patient satisfaction	0	9	8



This study demonstrates that both VISTA with tuberosity graft with intrasulcular tunnelling using VISTA with intrasulcular tunnelling and using palatal SCTG effectively treat gingival recession. The test group showed superior results in KTW increase, possibly due to the inherent thickness and stability of tuberosity grafts. On the other hand, the control group achieved better GRD reduction and CAL improvement, CAL gain because it provides The graft contains Source of progenitor fibroblasts genetic signals that stimulate keratinized tissue formation at the surface epithelium, which improves tissue resistance and attachment stability also induces keratinization, integrates vascularly, and stabilizes the gingival margin coronally, all of which result in stable and coronal re-establishment of the attachment apparatus compared to other grafts.[1] These findings align with previous reports highlighting the efficacy of connective tissue grafting as the gold standard in gingival recession management.[12,13]

Histologic and molecular studies have explored the reasons for the differing clinical outcomes between subepithelial connective tissue grafts (SCTG) and tuberosity connective tissue grafts (tCTG).[5] Jung et al. observed that tuberosity grafts contain a denser lamina propria but lower vascularity compared to SCTG, influencing healing and graft stability.[6] Fernández-Jiménez et al. also confirmed through systematic review that tuberosity grafts provide favourable soft tissue volume and keratinization, though palatal SCTG continues to show predictable root coverage outcomes.[15]

In contrast, SCTG has a higher proportion of submucosal tissue, including glandular and adipose components (25.75% in SCTG compared to 4.89% in tCTG). Evidence suggests that a greater amount of submucosal tissue in the graft can lead to increased graft shrinkage, reduced volume gain, and minimal or no impact on inducing keratinization of the epithelium.

These findings support the consideration of tCTG as a viable or potentially superior alternative to palatal connective tissue grafts, particularly when comparing it to grafts taken from the deep palate.[5]

On a molecular level, tuberosity connective tissue grafts (tCTG) exhibit decreased mRNA levels of collagen type I and III (COL-I and COL-III) compared to subepithelial connective tissue grafts (SCTG), along with an upregulation of lysyl hydroxylase 2 (LH2b) mRNA levels. Additionally, the LH2b/COL-1 ratio is four times higher in tCTG, indicating that tuberosity-derived collagen is less susceptible to degradation by metalloproteinases. This may explain the increased collagen accumulation in areas augmented with tCTG.[6,7]

The minimally invasive VISTA technique itself plays a significant role in treatment success. Zadeh first introduced this approach, which avoids marginal incisions and allows coronal advancement of gingival margins with minimal trauma.[2] Subsequent randomized controlled trials have shown VISTA to be comparable, and in some cases superior, to coronally advanced flap combined with SCTG, particularly for multiple recessions in the aesthetic zone [(13)]. Tavelli et al. emphasized that tunneling and minimally invasive methods, such as VISTA, reduce morbidity and enhance esthetic outcomes.[16]

tCTG also shows higher expression of LLH2 antibodies, commonly found in fibrotic tissues, and a greater potential for cytokeratin formation at the epithelial level, suggesting its role in promoting keratinization of peri-implant mucosa

So , tCTG and SCTG differ not only in their proportions of lamina propria and submucosa but also in gene expression patterns that may account for variations in clinical outcomes, such as keratinized tissue (KT) width gain, volume gain, and hyperplastic healing. tCTG is more fibrotic and prone to hyperplastic responses, and as recommended by Dellavia et al[7] its thickness should be limited to less than 3 mm.[7]

VISTA, as a minimally invasive technique, involves accessing the alveolar bone through one or more vertical incisions in the vestibule, avoiding any incisions on the gingival margins or papillae. This method has proven effective in achieving both bone and soft tissue augmentation.[8]

Using the subepithelial connective tissue transplant via trapdoor technique, solitary and multiple root systems can achieve complete root coverage. It uses a single treatment that results in a smooth postoperative course and less palatal denudation. This method was created especially to address the broad multiple recessions that are commonly observed in the maxilla, where obtaining root coverage appears to be the most challenging.[9]

While the at tuberosity site healing occurs comparatively faster and patient is less uncomfortable compare to palatal graft. But trapdoor technique made healing faster comparison to other counterpart SCTG harvesting techniques.[10]

Meta-analyses further confirm that tunnelling approaches are effective and provide advantages in treating multiple adjacent recessions.[14] Barootchi et al. highlighted that tunnelling results in stable long-term root coverage with lower morbidity compared to conventional flap techniques. Similarly, Tavelli et al.[12] reported that connective tissue grafting remains essential, but minimally invasive designs like VISTA optimize patient comfort and esthetics.

Additionally, PRF membranes used in this study have contributed to accelerated healing and improved outcomes. Abdelhaleem et al.[11] recently demonstrated the benefit of combining VISTA with advanced PRF, which enhanced angiogenesis, tissue maturation, and early wound stability in gingival recession defects.[11]

Both therapies successfully decreased the CAL in our study, however the PRF help in faster healing. The relocation of the attachment mechanism in the coronal direction after VISTA treatments led to recession coverage, which was expected to increase CAL. According to earlier studies, the VISTA approach encourages the gingival margin's coronal movement. Although the exact cause of the coronal covering following VISTA method is unknown, it might be brought on by the fibroblasts' contractility and the active healing processes that promote the attachment apparatus's coronal movement. Furthermore, PRF's concentrated growth factors promote angiogenesis, tissue migration, and tissue regeneration.[11]

Taken together, the literature supports the conclusion

that both tuberosity and palatal SCTG grafts are viable choices, with VISTA serving as a reliable minimally invasive technique. Tuberosity grafts appear advantageous when greater KTW and reduced donor site morbidity are priorities, whereas palatal grafts may provide superior CAL and RD improvements. Future studies with larger sample sizes and longer follow-up are needed to validate these preliminary findings.[12-16]

The coronally anchored suturing technique ensures stable fixation of the gingival margins, significantly reducing micromotion at the regenerative site. This reduction in micromotion offers a notable advantage over traditional methods, where the gingival margins may shift due to facial movements.[4]

Postoperative pain levels were comparable between groups, suggesting that both techniques are well-tolerated. However, esthetic satisfaction was slightly higher in the test group, likely because of the thicker and more robust appearance of the grafted tissue.

Limitations include the single-patient design and short follow-up duration. Future studies with larger sample sizes and long-term evaluation are warranted to confirm these findings.

CONCLUSION

Both VISTA with tunnelling using tuberosity graft and VISTA with tunnelling using palatal SCTG are effective techniques for managing gingival recession. VISTA with tunnelling using tuberosity graft showed better outcomes in terms of KTW increase and esthetic satisfaction, while VISTA with tunnelling and palatal SCTG provided superior GRD reduction and CAL gain along with of KTW increase. The choice of technique should be tailored to individual patient needs and clinical scenarios.

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