



Minimally Invasive Titanium Tacks-Assisted Soft Tissue Stabilization for Lingual Flap Fixation and Vestibulo-Lingual Sulcoplasty

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ABSTRACT

Introduction: In general, most countries have a rising life expectancy and an aging population. This may lead to a need for more complicated oral rehabilitation based on dental implants. The vestibular depth, either on the buccal or lingual side of the edentulous ridge, is a crucial factor in the planning of dental implant therapy. Due to the existence of lingual anatomic features, the rebuilding of the lingual sulcus may be regarded as a more difficult procedure. A severe atrophic ridge of the mandible might be considered one of the most challenging clinical situations, which may lead to inadequate lingual sulcus depth. To increase the depth of the lingual sulcus, several methods were proposed; however, the present case describes a novel surgical approach using bone tacks to address the problem.

Materials and Methods: At the second stage of implant surgery, an inadequacy of keratinized tissue was observed in the buccal and lingual regions. To solve this problem, a flap was created with the keratinized tissue positioned mostly on the lingual side. A free gingival graft taken from the palatal area was used in the accordion approach for soft tissue management on the buccal side. For lingual side management, all existing keratinized tissue was apically fixed via a sharp dissection and two minimally invasive bone Tacks.

Results: A 10-month follow-up after vestibulo-lingual sulcoplasty showed a significant improvement in lingual (4 mm) and buccal (6 mm) vestibular depth when compared to the baseline measurements.

Conclusion: The tack-assisted soft tissue stabilization (TASS) technique showed the potential to surpass conventional suturing methods in lingual flap fixation, owing to its minimally invasive approach. This technique offers stable flap fixation, surgical convenience, efficiency, and the preservation of keratinized gingiva around the implants.

Keywords: Dental implants; Vestibuloplasty; Denture; Overlay; Alveolar bone loss; Implant-supported overdentures.

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Introduction

In many cases of severely atrophic ridges, pre-prosthetic surgeries like vestibuloplasty and reduction of genial tubercle were used to enhance prosthesis stability or retention [1]. However, the advent of dental implants has significantly curtailed the application of these procedures [2]. A lack of adequate keratinized tissue around endosseous dental implants is associated with greater plaque accumulation, tissue inflammation, mucosal recession, and Attachment Loss, according to the available evidence [3]. When evaluating outcomes of mandibular implant-assisted overdentures, higher plaque index and gingival index scores were noted at implant sites without adequate keratinized mucosa. Since healthy peri-implant soft tissues are important for implant success, it is essential to monitor soft tissue parameters around implants during initial healing and after loading [4].

Recent studies showed that peri-implant mucosal inflammation and patient discomfort can be notably diminished with a successful Free Gingival Grafting (FGG) [5]. Considering this, a study has concluded that FGG is the most reliable technique for augmenting the Keratinized Tissue Width (KTW) around dental implants, thereby reducing the probing depth and plaque index compared to non-grafted sites. FGG has a high degree of success when utilized to widen the keratinized tissue and deepen the buccal vestibule, but there isn't a reliable method for doing the same for the lingual vestibule's soft tissue [6]. Addressing this gap, Trauner introduced a surgical technique in 1952 involving secondary epithelialization for lingual sulcoplasty, which proved to be effective. Moreover, a button-suture technique, often used in orthopedics, can be considered for lingual sulcoplasty surgery [7,8].

This technique, initially intended for syndesmosis repairs, provides advantages, such as reduced skin tension, improved patient comfort, and decreased infection rates [9]. This study aimed to propose 'titanium tack-assisted soft tissue stabilization' (TASS) as an alternative method for fixation of lingual soft tissue and increasing lingual vestibular depth. However, large-scale studies are needed to ascertain the relapse of treatment, long-term peri-implant status, and patient-reported outcomes. To solve these problems, advance science, get access to more keratinized tissue, and eventually improve the health of the soft tissue around implants, this study aims to further investigate the lingual sulcoplasty innovation that uses titanium tacks.

Case History

A 66-year-old female patient without any medical history was referred to the Department of Periodontics at Tehran University of Medical Sciences for implant placement (Figure 1). The chief complaint was difficulty in chewing function and mobile teeth (Figure 2).

Materials and Methods

• Differential Diagnosis and Investigation

A cone-beam CT scan showed severe alveolar bone resorption in the posterior area (Figures 3 and 4). The prosthetic treatment plan entailed a mandibular overdenture.

• Treatment

After extracting teeth that were hopeless and significantly supra-erupted, ridge reduction was conducted using a saw to create an adequate occlusal clearance and a wider basal bone with a thick cortical plate (Figures 5 and 6). At the time of implant placement, due to the inadequate width of keratinized tissue, the crystal incision was placed in the middle of the keratinized tissue, dividing the flap into buccal and lingual sections equally. Three tissue level implants (Straumann®, Institute Straumann AG, Basel, Switzerland; 10 mm length, 4.1 mm diameter, SP, RN) were correctly inserted based on Misch classification (at A, C, and E position), and cover screws (Straumann®, Institute Straumann AG, Basel, Switzerland; 0 mm, 024.4100s) were placed at the time of implant insertion (two-stage approach) (Figures 7, 8, and 9). Flap closure was performed with simple interrupted 5-0 nylon sutures. Post-operative instructions included oral systemic antibiotics (amoxicillin 500 mg every 8 hours for 7 days), analgesics (ibuprofen 400 mg every 6 hours for 7 days), and antiseptic mouthwash (chlorhexidine digluconate 0.12% every 12 hours for 14 days).

Three months later, an insufficiency of keratinized tissue was observed in buccal and lingual areas. A flap was prepared to predominantly position the keratinized tissue on the lingual side. Simultaneously, healing abutments (Straumann®, Institute Straumann AG, Basel, Switzerland; 10 mm height) were placed. To increase the buccal vestibular depth and keratinized mucosa, a free gingival graft was harvested from the palatal donor area. The accordion technique was used to increase the donor graft tissue length (Figures 10 and 11). After accordion preparation, the graft was fixed on the recipient area using nylon 6.0 sutures (Figure 12). Two minimally invasive bone titanium tacks, measuring 1.5

mm in diameter and 3 mm in length (jeil JT-CL-03 Tac 3 mm), were used to secure the partial-thickness flap that comprised all of the keratinized tissue already present for soft tissue management on the lingual side. Post-operative instructions were consistent with the earlier phase, including antibiotics, nonsteroidal anti-inflammatory drugs, and mouth rinse. The sutures were removed after 21 days, and titanium tacks were released 14 days after surgery. The healing period was uneventful and without any serious complications (Figure 13).

Results

• Outcome and Follow-Up

A 10-month follow-up after mandibular vestibule-lingual septoplasty and accordion FGG revealed significant enhancement in lingual (4 mm) and buccal (6 mm) vestibular depth compared to baseline measurements (Figures 14 and 15). Vestibular depth and an appropriate level of keratinized mucosa were attained and sustained for a short time. This may result in effective plaque management and healthy peri-implant tissue. Peri-implant soft tissue was securely secured thanks to titanium tacks rather than traditional suturing.



Figure 1. Panoramic radiography of the patient at the time of referral.



Figure 2. The condition of the patient's teeth at the time of the first visit.

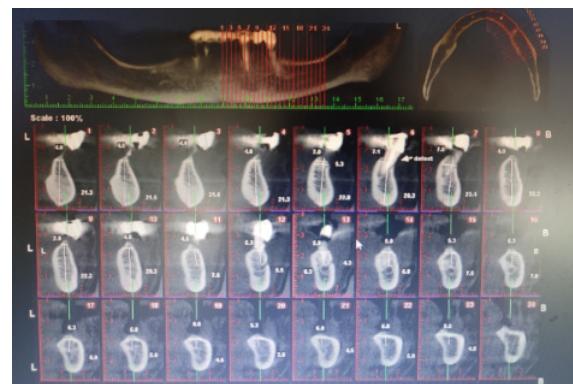


Figure 3. CBCT of the patient and severe bone loss.

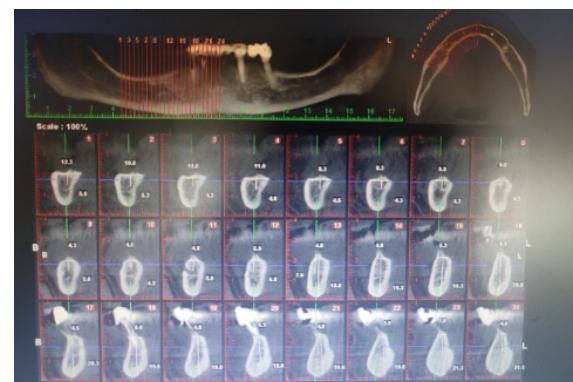


Figure 4. CBCT of the patient and severe bone loss.

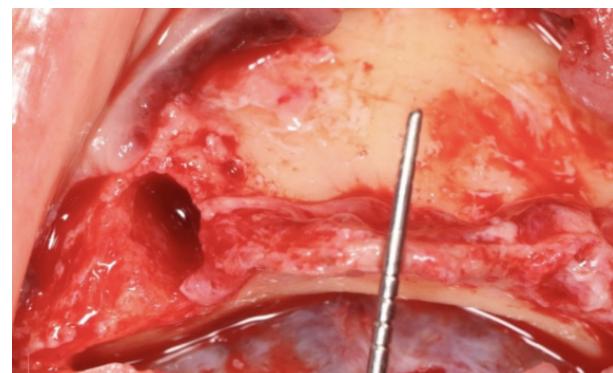


Figure 5. Bone width at the time of tooth extraction.



Figure 6. Using a saw to flatten the surface of the bone.



Figure 7. Placement of 3 parallel implants immediately after tooth extraction.



Figure 8. Placement of 3 parallel implants immediately after tooth extraction.



Figure 9. Panoramic radiography after implant insertion.



Figure 10. Accordion flap.



Figure 11. Prepared substrate for grafting and Two minimally invasive bone titanium tacks, measuring 1.5 mm in diameter and 3 mm in length (jail JT-CL-03 Tac 3 mm), were used to secure the partial-thickness flap that comprised all of the keratinized tissue already present for soft tissue management on the lingual side.



Figure 12. Suture the grafted area with 6-0 nylon.



Figure 13. 14 days after surgery.



Figure 14. A 10-month follow-up after mandibular vestibulo-lingual sulcoplasty.



Figure 15. A 10-month follow-up after mandibular vestibulo lingual sulcoplasty.

Discussion

The present case report study introduced tack-assisted soft tissue stabilization for mandibular vestibulo-lingual sulcoplasty. The short-term outcome showed the efficacy of this technique in increasing lingual vestibular depth in severe atrophic mandibular ridges. The management of patients with severe mandibular ridge resorption presents a considerable challenge in prosthodontics. After severe ridge resorption, muscle attachments relocate coronally, and the result will be shallow vestibular depth in the buccal and lingual sides. Traditional complete denture therapy often falls short of providing sufficient retention and stability for these cases [10]. Overdentures supported by implants have become a viable therapeutic option as a result, providing better dental health-related quality of life [11]. However, excessive mandibular ridge resorption might result in a lack of keratinized mucosa and inadequate buccal and lingual vestibular depth, all of which are essential for the long-term success of implant-supported restoration [12].

The free gingival graft is a predictable approach for increasing keratinized tissue width and vestibular deepening in the buccal area [13]. This treatment gap underscores the necessity for alternative techniques, like lingual sulcoplasty. Case studies have effectively shown the management of severe mandibular ridge resorption via lingual sulcoplasty techniques. One way to address these challenges is using lingual septoplasty via the Button-Suture Technique, a surgical method that proves advantageous in reconstructing the lingual vestibular depth for patients with a severe mandibular ridge. The button-suture technique involves repositioning the mylohyoid and genioglossus muscle attachments to correct elevated mouth floor and tongue positions. The lingual flap is stabilized and lessens muscle stress by being fastened apically with horizontal

mattress sutures and buttons [14]. A modified method that combines lingual septoplasty with a free gingival graft may be used in situations with insufficient keratinized tissue breadth and shallow buccal and lingual vestibule. This technique aims to enhance keratinized tissue around dental implants and increase the lingual vestibular depth. The procedure entails inserting tissue-level implants in the accurate prosthetic position, followed by healing abutment placement. If inadequate keratinized tissue is noted after 3 months, a free gingival graft procedure augments buccal vestibular depth and keratinized mucosa. Subsequently, lingual sulcoplasty is performed to address the diminished lingual vestibular depth, leading to improved outcomes for implant-supported overdentures [15]. Lingual sulcoplasty techniques offer effective solutions for patients with severe mandibular ridge resorption who are seeking implant-supported reconstruction. Techniques like mucosal advancement vestibuloplasty, and closed submucous vestibuloplasty can significantly enhance lingual vestibular depth and increase keratinized mucosa width around dental implants [16]. In our presented technique, the titanium tack-assisted soft tissue stabilization (TASS) method brings notable advantages over conventional suturing techniques in flap fixation.

The TASS technique makes sure that the flap is securely fixed, lowering the possibility that it may shift throughout the healing process and consequently improving clinical results. As the use of titanium tacks removes intricate suturing and reduces difficulties associated with conventional anchoring techniques, it also enhances surgical ease and patient comfort. This streamlined approach not only saves surgical time but also ensures precise flap positioning for optimal alignment with adjacent tissues, contributing to improved aesthetics, patient confidence, and treatment satisfaction. One of the potential drawbacks of this technique is the risk of ischemic flap necrosis, so sufficient stability of the flap was established with a minimum number of tacks. Proper graft fixation in the recipient site is crucial for successful soft tissue grafting surgery. When a graft is properly fixed in the recipient site, it helps minimize shrinkage during the healing period and ensures there is no disruption in the blood supply to the area. This is important for the overall success of treatment. One limitation of using a free gingival graft in the anterior mandible to deepen the lingual vestibule is poor graft fixation with the suturing technique. It means that when the graft is secured using sutures, it may not be firmly and securely attached, which can affect the outcome of the procedure [17]. In these cas-

es, the use of titanium tacks can be beneficial. Tacks can help limit the movement of muscles in the area by properly fixing the soft tissue structure apically. This method of fixation may provide better results compared to sutures. Despite the advantages of TASS, there are potential drawbacks that must be considered. One major concern is the risk of ischemic flap necrosis if the tacks are not placed correctly, potentially compromising the blood supply to the graft [18]. Furthermore, the stability of the graft may be an issue if the tacks do not hold firmly, leading to potential graft failure [19]. Additionally, the TASS method may not be as effective in cases of very severe bone loss and extremely shallow vestibules, where other techniques like the button technique may be more suitable [20]. However, it is important to note that for cases with very severe bone loss and a very shallow vestibule, other techniques, such as the button technique, may be superior to TASS. These alternative techniques might be more suitable in situations where the TASS method might not be as effective.

The TASS method is particularly indicated in cases with moderate bone loss and where traditional suturing techniques have proven inadequate. It is also beneficial in patients requiring enhanced stability of the graft to ensure successful healing. TASS can provide superior results by minimizing muscle movement and ensuring the graft remains securely fixed during the critical healing period. However, in scenarios of severe anatomical challenges, alternative techniques such as the button technique may be preferred. The titanium tack-assisted soft tissue stabilization (TASS) technique surpasses conventional suturing methods in flap fixation. The TASS approach represents a revolutionary change in oral surgery since it offers greater fixation, surgical convenience, efficiency, preservation of keratinized gingiva, and superior esthetic outcomes. Embracing this innovative approach empowers clinicians to achieve more predictable and successful outcomes, ultimately benefiting the patients under their care.

Conflict of Interest

There is no conflict of interest to declare.

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