

## CASE REPORT

# Reconstruction of lingual sulcus in a severely atrophic mandible using a modified approach as a pre-prosthetic surgery: Case series

Seyed Hossein Mohseni Salehi Monfared<sup>1</sup> | Gholamreza Shirani<sup>2</sup>  | Neda Moslemi<sup>1</sup> | Faranak Noori<sup>3</sup> | Amir Raei<sup>1</sup> 

<sup>1</sup>Department of Periodontology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>2</sup>Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>3</sup>Department of Endodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

## Correspondence

Amir Raei, Department of Periodontology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

Email: amirraei@yahoo.com

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## Abstract

Shallow lingual vestibule and lack of keratinized attached mucosa are considered risk factors for the long-term success of dental implants. This article describes a modified surgical approach accompanied by a free gingival graft to correct the shallow lingual/buccal vestibule and to increase the keratinized tissue around dental implants.

## KEYWORDS

alveolar bone loss, dental implants, denture overlay, mouth floor, suture technique

## 1 | INTRODUCTION

Treatment of patients with severe mandibular ridge resorption is a challenging issue. Due to the problems related to the retention and stability of the prosthesis, conventional complete denture therapy is not an acceptable solution in such patients. Instead, implant-supported overdenture is a viable treatment option in these patients and is associated with an improved oral health-related quality of life.<sup>1</sup> Severe mandibular ridge resorption causes the muscle attachments to be near or at the level of the crest of the ridge. Consequently, there is an insufficient buccal and lingual vestibular depth and a lack of adequate keratinized mucosa, which are critical factors in the long-term

success of implant-supported reconstruction.<sup>2,3</sup> Free gingival graft (FGG) is routinely used as a predictable treatment option for the augmentation of buccal peri-implant keratinized attached mucosa and buccal vestibular deepening.<sup>4</sup> However, to the best of our knowledge, at present, there is no well-documented method for augmentation of lingual peri-implant keratinized attached mucosa and deepening the lingual sulcus around dental implants. This study describes the management of two cases with severe mandibular ridge resorption, lack of keratinized tissue width (KTW), and shallow buccal and lingual vestibule. The purpose of the pre-prosthetic surgery was to enhance the lingual vestibular depth and to increase the KTW around dental implants.

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## 2 | CASE PRESENTATION

### 2.1 | Case 1

A 70-year-old male patient with no medical history was referred to the Department of Periodontology for implant placement. The chief complaint was inadequate retention of the mandibular prosthesis. The cone-beam CT scan showed severe alveolar bone resorption. The prosthetic treatment plan for the patient was a mandibular overdenture option 2.<sup>5</sup>

At the time of implant placement, due to the reduced width of keratinized tissue (Figure 1A), the crestal incision was placed in the middle of the keratinized tissue, dividing the flap equally into buccal and lingual parts. Three tissue level implants (Straumann®, Institute Straumann AG, Basel, Switzerland; 10 mm length, 4.1 mm diameter, SP, RN) were inserted in a correct prosthetic position according to Misch classification.<sup>5</sup> The surgery was uneventful, and the healing abutments (RN, H 4.5) were installed at the time of implant insertion. The flap was closed with nylon 4.0 and simple interrupted sutures (Figure 1B–D).

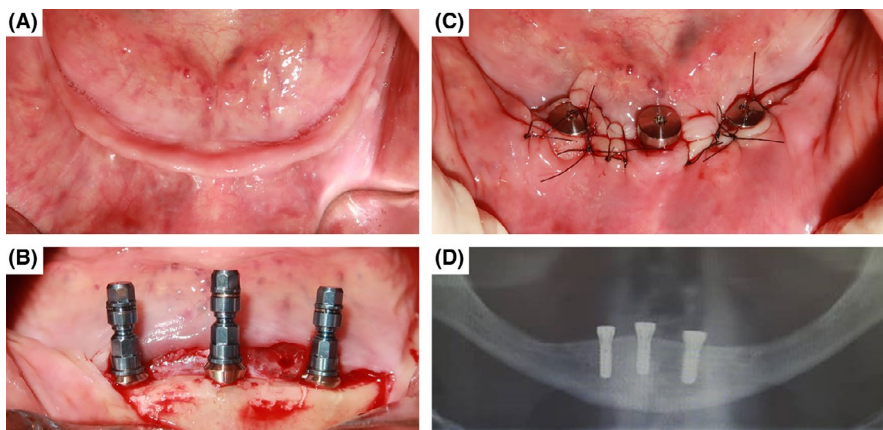
After 3 months, we noted that the floor of the mouth completely covered the healing abutments, and there was a lack of keratinized tissue in buccal and lingual areas (Figure 2A). At this stage, the FGG procedure was performed to expose the implants and increase the buccal vestibular depth and keratinized mucosa around dental implants (Figure 2B–D).

After 2 months, an adequate zone of keratinized mucosa was evident in the buccal side, and the buccal vestibular depth increased significantly. The mean buccal vestibular depth was 10 mm. However, the clinical examination revealed an elevated mouth floor and a reduced lingual vestibular depth (Figure 3A). To address this issue, repositioning of the mouth floor was performed under local anesthesia using a modification of the method introduced by Trauner.<sup>6</sup> A partial-thickness flap was raised on the lingual side. Soft tissue dissection was

carefully carried out to avoid injuries to the anatomical structures such as the sublingual gland, submandibular duct, and lingual nerve. The high position of mylohyoid and genioglossus muscles attachments was evident. These attachments were incised and relocated apically using horizontal mattress sutures. To facilitate passing the needle through tissues, a 23-gauge needle was used with a 3/0 silk suture. The needle was first passed through the extraoral submental area reaching the mylohyoid muscle and then engaging the lingual flap from its buccal (inner) side. Passing through the lingual flap, the needle again engaged the mylohyoid muscle and exited the extraoral submental triangle. The knot was tied using a button, which served as a suture anchor on the skin. The lingual flap and mylohyoid muscle were fixed apically using three horizontal mattress sutures and three buttons (Figure 3B–E). After the operation, 3% tetracycline dressing was placed on buttons to prevent infection and cutaneous irritation.

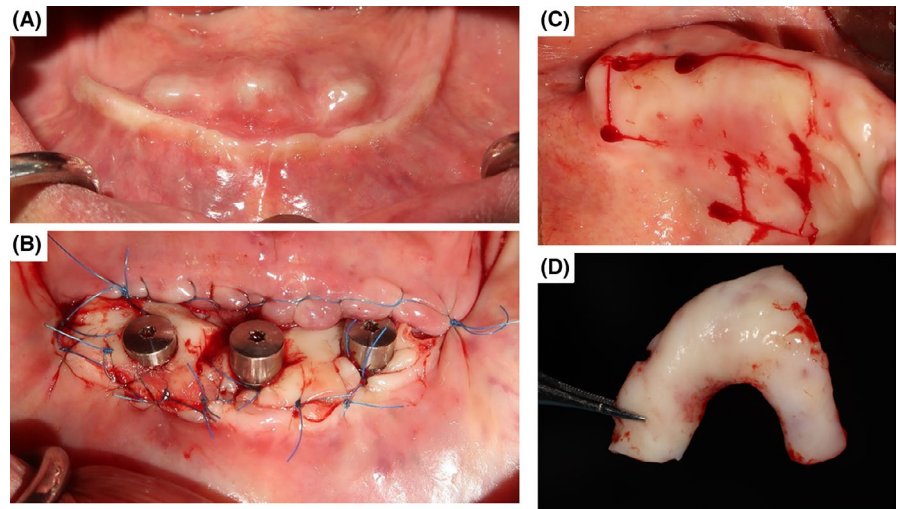
The post-operative protocol included consumption of antibiotics (Cephalexin 500 mg every 8 h for 7 days), nonsteroidal anti-inflammatory drug (Ibuprofen 400 mg every 8 h for 3 days), and rinsing with mouth rinse (0.12% chlorhexidine digluconate every 12 h for 14 days). The tetracycline dressing was removed 3 days after surgery, and the patient was prescribed a topical application of 3% tetracycline ointment on the contact areas between buttons and the skin for 3 weeks. The sutures were removed after 21 days. The healing was uneventful, and significant mouth floor apical repositioning was achieved.

After 1 month, gingivoplasty was done to even the buccal soft tissue contour (Figure 4). A 10-month follow-up period following the lingual sulcoplasty showed significant improvement in the lingual (5 mm) and buccal (4 mm) vestibular depth, compared to baseline values (Figure 5). As evident, the result was relatively stable, and the patient was satisfied with functional rehabilitation. The probing depth around dental implants was within normal limits (2–3 mm).

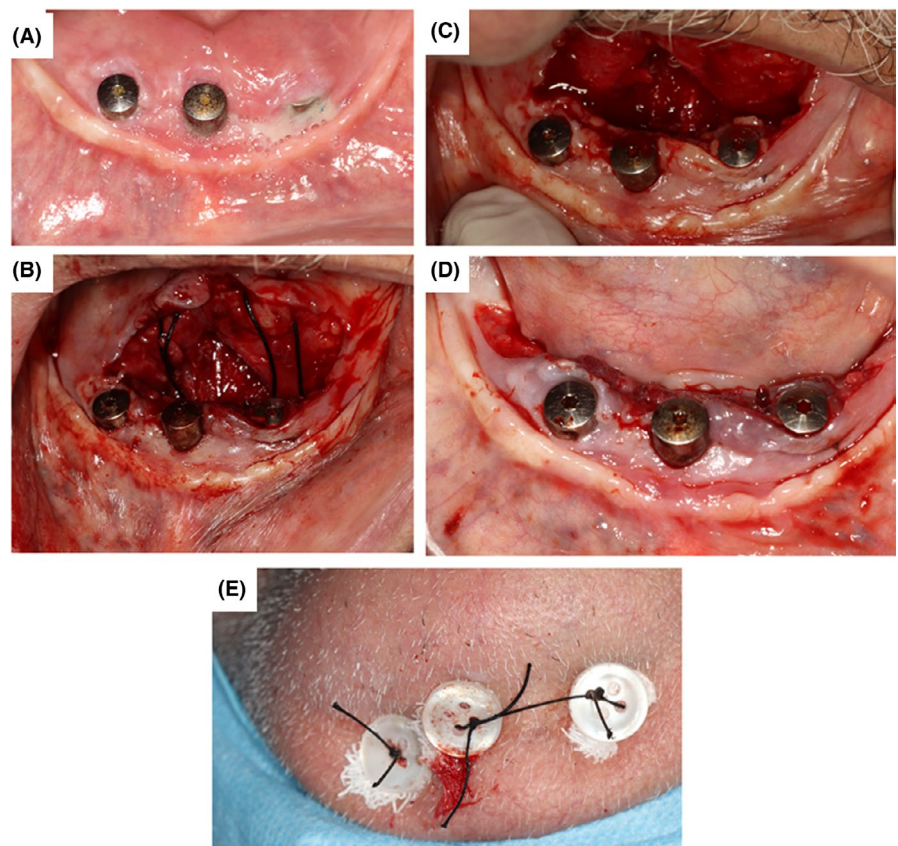


**FIGURE 1** (A) Baseline clinical condition. (B–D) Implant insertion, three tissue level Straumann Standard Plus (SP, RN) implants (10 mm length and 4.1 mm diameter)

**FIGURE 2** (A) Oral mucosa of the mouth floor completely covered the healing abutments after a 3-month follow-up. (B and C) Harvesting free gingival graft in "L-shape" pattern. (D) Fixation of the graft



**FIGURE 3** (A) Mouth floor elevation condition. (B and C) Lingual sulcoplasty using horizontal mattress sutures and button-suture technique. (D and E) Lingual flap was fixed in the apical position



## 2.2 | Case 2

A 60-year-old woman with no past medical history was referred to the department of periodontology. The chief complaint was mobile dental implants and discomfort with the overdenture. At the first step, the implants were explanted, and guided bone regeneration was performed to reconstruct the bony defects (Figure 6). After 6 months, there were shallow buccal vestibular (1 mm) and lingual sulcus (1 mm) depths and a lack of KTW. Two implants (Straumann®, Institute Straumann AG, Basel, Switzerland;

10 mm length, 4.1 mm diameter, SP, RN) were inserted based on the overdenture treatment planning to rehabilitate the fully edentulous mandibular atrophic ridge (Figure 7).

After 4 months, an inadequate KTW and high position of mylohyoid and genioglossus muscles attachments were noted. Therefore, during the second stage surgery, FG and simultaneously modified lingual sulcoplasty were performed (Figures 8 and 9). The surgical technique of lingual sulcoplasty and the post-operative protocol was similar to the above-mentioned first case.



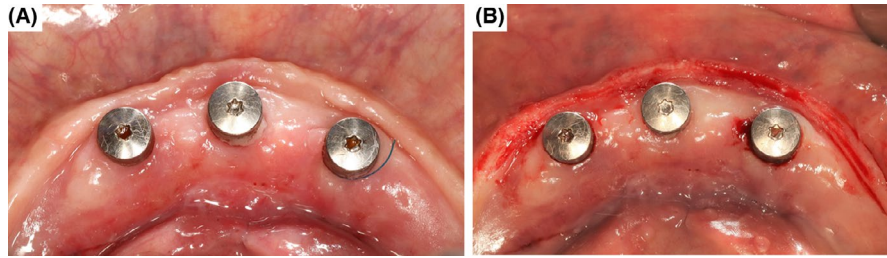


FIGURE 4 Gingivoplasty to even the buccal soft tissue contour. (A) Preoperative view. (B) Post-operative view

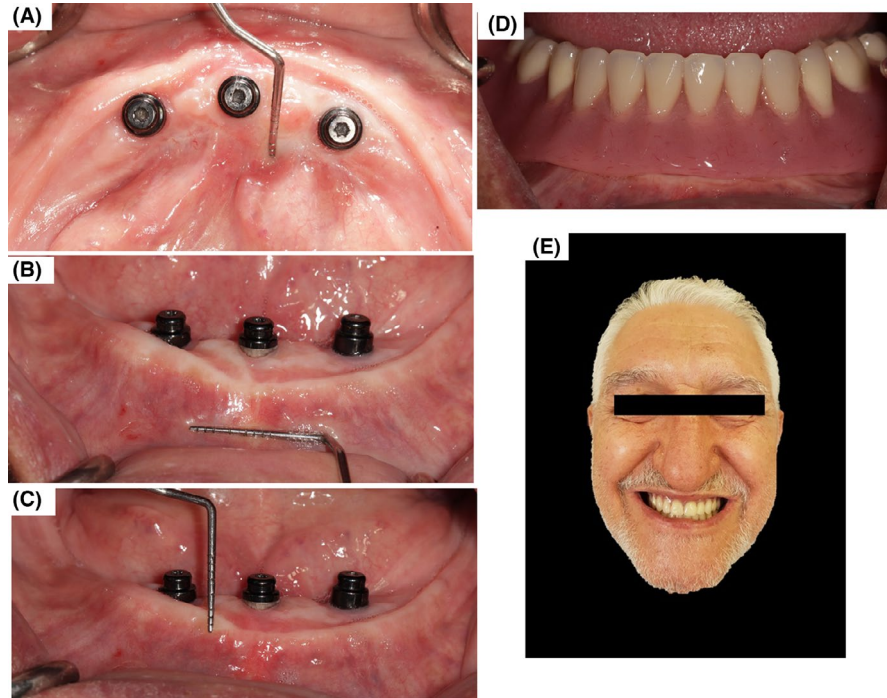


FIGURE 5 (A–C) 1-month follow-up after lingual sulcoplasty. (D and E) Final Prosthesis

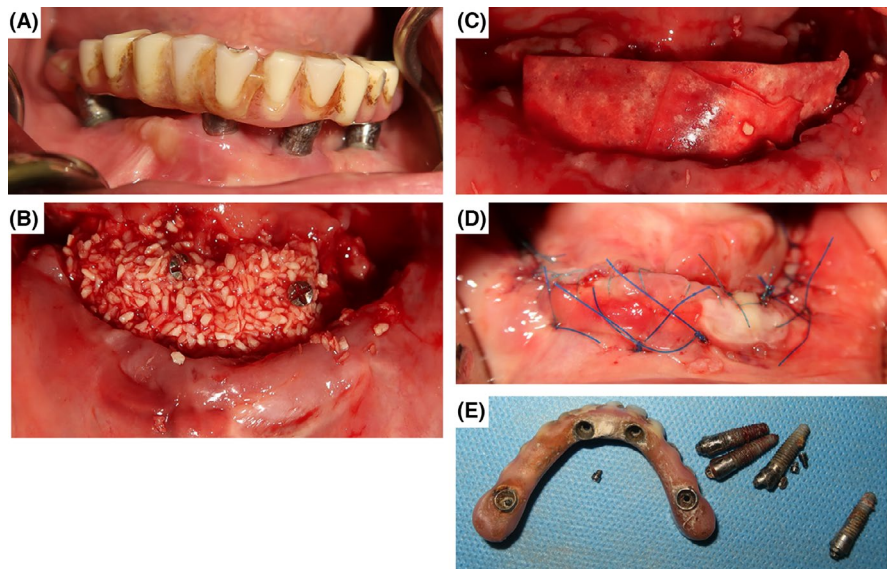


FIGURE 6 (A–E) Explantation and guided bone regeneration

FIGURE 7 (A–D) Implant insertion

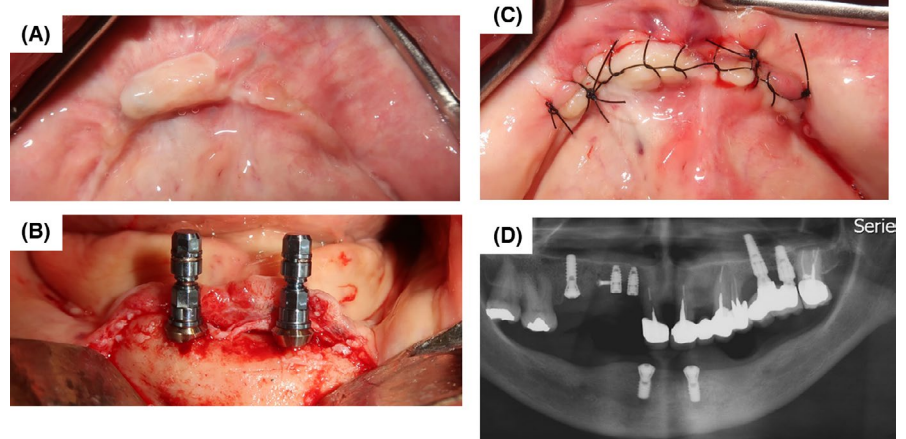


FIGURE 8 (A and B) Inadequate keratinized tissue width, buccal vestibule, and lingual sulcus. (C–E) Simultaneous free gingival graft with modified lingual sulcoplasty

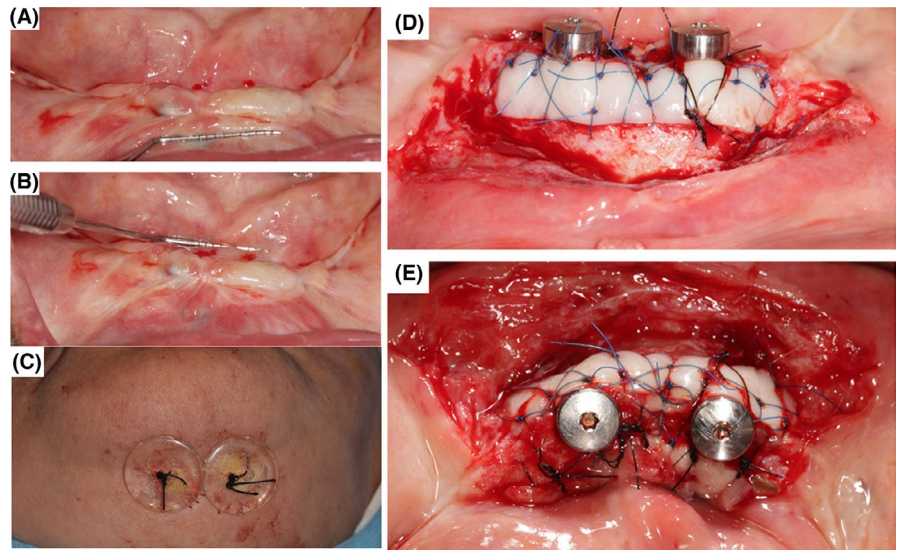
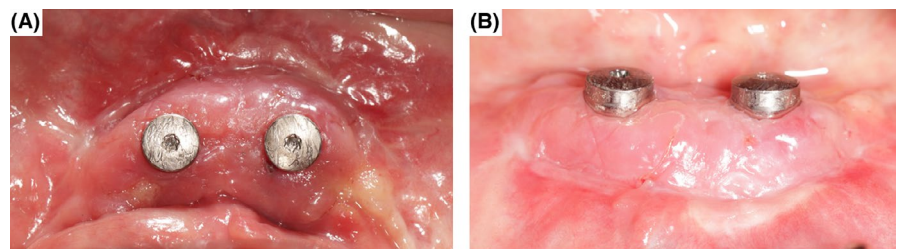


FIGURE 9 One-month follow-up after lingual sulcoplasty. (A) Occlusal view; (B) Buccal view



After 6 months (Figure 10), there was a sufficient and stable band of attached keratinized tissue, lingual sulcus (6 mm), and buccal vestibular depth (7 mm). The peri-implant tissues were healthy without any signs of inflammation.

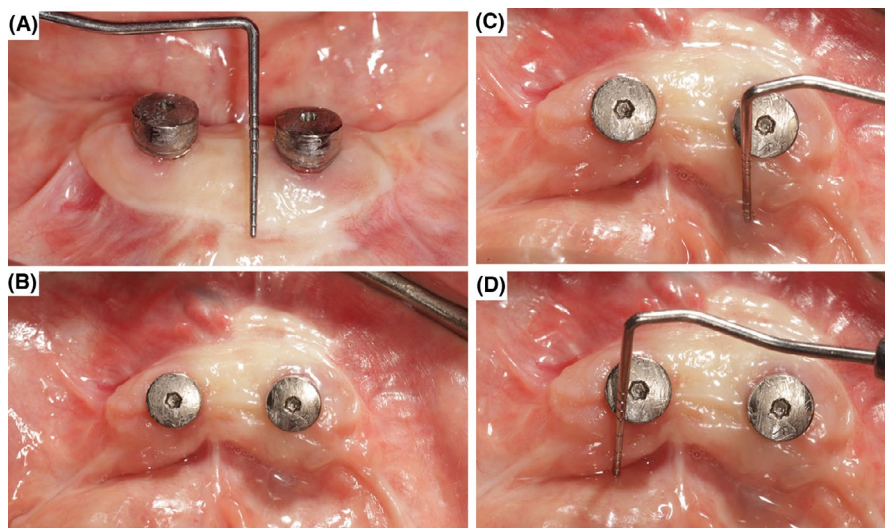
### 3 | DISCUSSION

In the present case series, the *button-suture* lingual sulcoplasty, a pre-prosthetic surgery, was comprehensively described. The quantitative measurements of the outcomes

in the short-term follow-up showed that this approach might effectively enhance the lingual sulcular depth in severely resorbed mandibular ridge. Additionally, lack of KTW, a common finding in such cases, was increased with FG. G.

Dental implant rehabilitations are predictable treatments with a high success rate.<sup>7</sup> Traditionally, the treatment option for an atrophic mandibular edentulous ridge was a complete removable denture. Many cases with atrophic ridges require pre-prosthetic surgeries, such as vestibuloplasty and lowering the mouth floor in order to improve the stability or retention of the prosthesis.<sup>8</sup> With





**FIGURE 10** Six-month follow-up after lingual sulcoplasty; (A) Buccal keratinized tissue width, (B) Occlusal view, (C and D) Lingual sulcus depth

the growing use of dental implants, the application of these procedures has been limited significantly. However, the scientific evidence supports the importance of an adequate zone of keratinized attached mucosa and buccal/lingual vestibular depth around dental implants for the peri-implant tissue health and the long-term success of implant therapy.<sup>2,8-12</sup> Several studies showed that peri-implant mucosal inflammation and patient discomfort reduce significantly, following a successful FGG procedure.<sup>11,13</sup> A recent systematic review concluded that FGG was the most predictable technique for increasing the KTW around dental implants and was associated with reducing probing depth and plaque index compared to non-grafted sites.<sup>4</sup> FGG is also used for increasing the buccal vestibular depth in implant rehabilitation.<sup>2</sup> Comparing FGG with classic vestibuloplasty, it was found that FGG led to more attached mucosa width around dental implants. A lower rate of relapse was demonstrated in the FGG group, as well.<sup>14</sup> Although FGG is routinely performed as a predictable procedure to augment the keratinized attached mucosa and deepen the buccal vestibular depth, there is no documented method to deepen the lingual vestibule. In the present case series, FGG was performed to enhance the KTW around dental implants. The clinical outcomes in the follow-up sessions showed an increase in KTW which were consistent with the results of the previous studies.<sup>4,9</sup>

Patients with severe atrophic mandibular ridges usually present with high muscle attachments. Thus, repositioning these muscle attachments can correct the elevated mouth floor and tongue positions, leading to the ideal prosthesis function and stability.<sup>15</sup> A surgical technique with secondary epithelialization for lingual sulcoplasty was conducted by Trauner in 1952. The results were reported to be favorable with this approach.<sup>6</sup> Obwegeser proposed a flap technique covering the lingual surface of the bone with the mucous membrane of the floor of the

mouth after separating it from the muscle. With this technique, "the incision wound was placed in the bottom of the lingual sulcus, leading to scar formation and more relapse".<sup>16</sup> The technique was complex, and the results were impaired because the lingual edge of the mucous membrane was not repositioned sufficiently.<sup>6</sup> Rosenquest et al. proposed another method for this purpose with primary healing on the lingual side. They sutured the lingual flap apically while the surgical knot was fixed on the buccal vestibule. The flap was sutured in a primary intension manner. The results were favorable, but this procedure should be performed under general anesthesia, as the authors suggested. It was complicated, and the length of the operation time was increased.<sup>16</sup>

It has been suggested that the incidence of relapse using the secondary epithelialization method is low.<sup>16</sup> We operated the lingual sulcoplasty according to Trauner's method<sup>6</sup> along with using the *button-suture* technique. In orthopedics, the *button-suture* fixation is indicated for syndesmosis repairs with or without ankle fractures.<sup>17-19</sup> In a recent randomized clinical trial with a 5-year follow-up, patients treated with *button-suture* for the acute syndesmotic injury had better results than patients treated with screw fixation.<sup>18</sup> The *button-suture* technique can be considered for lingual sulcoplasty surgery. We found that using a button during apical fixation of the muscles would be very helpful in lingual sulcoplasty surgery. This suturing technique provided less tension on skin to be cut when tension was applied through sutures. Thus, lower skin irritation can lead to more patient comfort and a lower infection rate.

In the present study, soft tissue grafts were performed after implant placement. Although some studies suggested performing vestibuloplasty before implant placement,<sup>15,20,21</sup> most often, the formation of scar following such pre-prosthetic surgeries disturbs the flap management during the implant procedure. In the first case, the

surgical procedures were done in separate sessions as the patient could not tolerate the burden of simultaneous surgeries (FGG+lingual sulcoplasty). Comparing the results of the present two cases, it seems that both simultaneous and separate approaches can lead to favorable outcomes. However, this interpretation should be considered with caution due to the limited study sample size. It is suggested to conduct studies with a large sample size assessing the relapse of therapy, long-term peri-implant status, and patient-reported outcomes.

## 4 | CONCLUSION

In patients with severe mandibular ridge resorption, the shallow lingual vestibular depth could be managed with the *button-suture* technique for lingual sulcoplasty, and the lack of keratinized tissue width could be increased with a free gingival graft. These procedures might allow better peri-implant tissue health and a more predictable prosthetic reconstruction.

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None.

## CONFLICT OF INTEREST

The authors do not have any financial interests and report no conflicts of interest related to this study.

## AUTHOR CONTRIBUTIONS

Seyed Hossein Mohseni Salehi Monfared and Gholamreza Shirani involved in conceptualization and design—treatment supervision. Gholamreza Shirani and Faranak Noori drafted and critically revised the manuscript. Amir Raei involved in case selection and treatment—outcome measurements—drafting the manuscript.

## ETHICAL APPROVAL

The present case series study was reviewed and approved by the Ethics Committee of Dentistry, Tehran University of Medical Sciences, under the ID code: IR.TUMS.DENTISTRY.REC.1400.032.

## CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ORCID

Gholamreza Shirani  <https://orcid.org/0000-0002-6229-1320>

Amir Raei  <https://orcid.org/0000-0002-0620-8924>

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