Case Report

Prosthetic Assistance in Soft Tissue Management After Free Flap Reconstruction for Maxillectomy

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Abstract

Recently, microvascular free flap reconstruction has become an alternative to the use of traditional obturators for patients with maxillary defects. However, the free flap might interfere with the denture retention and stability of edentulous patients due to its mobile characteristic. In this case report, an implant-retained overdenture was used to assist in the soft tissue management after free flap reconstruction of a maxillary edentulous patient. This approach not only created a stable denture bearing area for the patient but also improved the patient's quality of life during the transitional stage.

Key words: flap revision, implant-assisted overdenture

Introduction

Traditionally, obturators have commonly been used to restore defects of the hard palate. An obturator provides a simple, non-surgical means of separating the oral and nasal cavities and concurrently restores speech and swallowing functions to a certain degree[1]. However, the potential for hypernasal speech and the possibility of food and liquid leaking into the nasal cavity will sometimes cause inconvenience to the patient, not to mention the difficulty of maintaining the hygiene of the defect[1,2].

Recent advances in microvascular surgery have provided an alternative method for restoring palatal defects, namely, flap reconstruction. Although flap reconstruction itself has disadvantages, such as higher complication rates and the possibility that the flap's bulk and movement might cause problems in prosthesis fabrication, the advantages it provides in terms of improving patient quality of life in numerous respects still make it an attractive treatment alternative for patients with palatal defects[2-5].

Nevertheless, the mobility of the flap and the fact that it is easily affected by gravity will cause difficulty in fabricating maxillary pros-

Fig. 1. Initial findings. (A) Extraoral view showed swelling and facial asymmetry of left labial side. (B) Intraoral view revealed a 6x4 cm2 verrucous mass on left maxillary gingiva and hard palate. (C) Panoramic film revealed no tumor-related bony change.

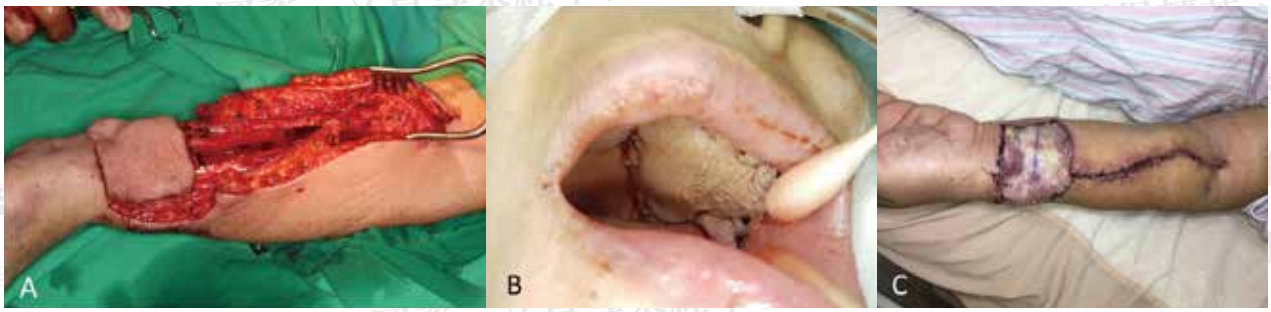

Fig. 2. Free flap reconstruction. (A) The radial forearm free flap was harvested from left arm. (B) Intraoral view of maxilla. (C) Donor site condition after free flap reconstruction.

theses[6-8]. In the case presented herein, an implant-retained overdenture was delivered to the patient, through the cooperative efforts of an oral surgeon and prosthodontist, to assist in the revision of the soft tissue after maxillary free flap reconstruction. This method provided not only a stable supporting area for the complete dentures, but also oral function during the healing period.

Clinical Report

A 70-year-old female patient visited the Oral and Maxillofacial Surgery Department of Taipei Medical University on 2016-10-12 with a complaint of gingival overgrowth noted for 6 months. She had recently suffered difficulty in wearing her dentures and exhibited obvious facial swelling.

Original status:

Intraoral examination showed a 6x4 cm^2 verrucous mass located on the left maxillary gingiva and hard palate. This pink, soft, and cauliflower-like mass extended over the upper left vestibule and left side of the soft palate. No bony change was noted in the panoramic examination (Fig. 1).

A biopsy was performed, and the pathological verification proved the diagnosis of squamous cell carcinoma. A wide excision for tumor removal combined with a partial maxillectomy was conducted, and the defect was immediately reconstructed with the radial forearm free flap (Fig. 2). The patient recovered well after the reconstruction.

Status after tumor excision and free flap reconstruction:

Six months later, the patient was referred to the prosthodontic department. An area of soft and mobile skin was found intraorally at the previously reconstructed site of the left maxilla. Scar constriction was noted around the flap-mucosa junction, mostly at the anterior margin, which drew down the upper lip and caused facial asymmetry (Fig. 3A).

A computed tomography scan of the maxilla revealed bony defects at the surgical site, especially around the canine to second premolar area, which was well covered by the faciocutaneous flap to prevent possible oroantral communication (Fig. 3B).

Since the patient had been wearing complete dentures for more than 30 years, and since she asked for a prosthesis that would be simple and easy to clean, a removable prosthesis was proposed. However, it was thought that the highly mobile and deformable flap might jeopardize denture retention and stability. Treatment options were discussed with the patient, and an implant-assisted overdenture was

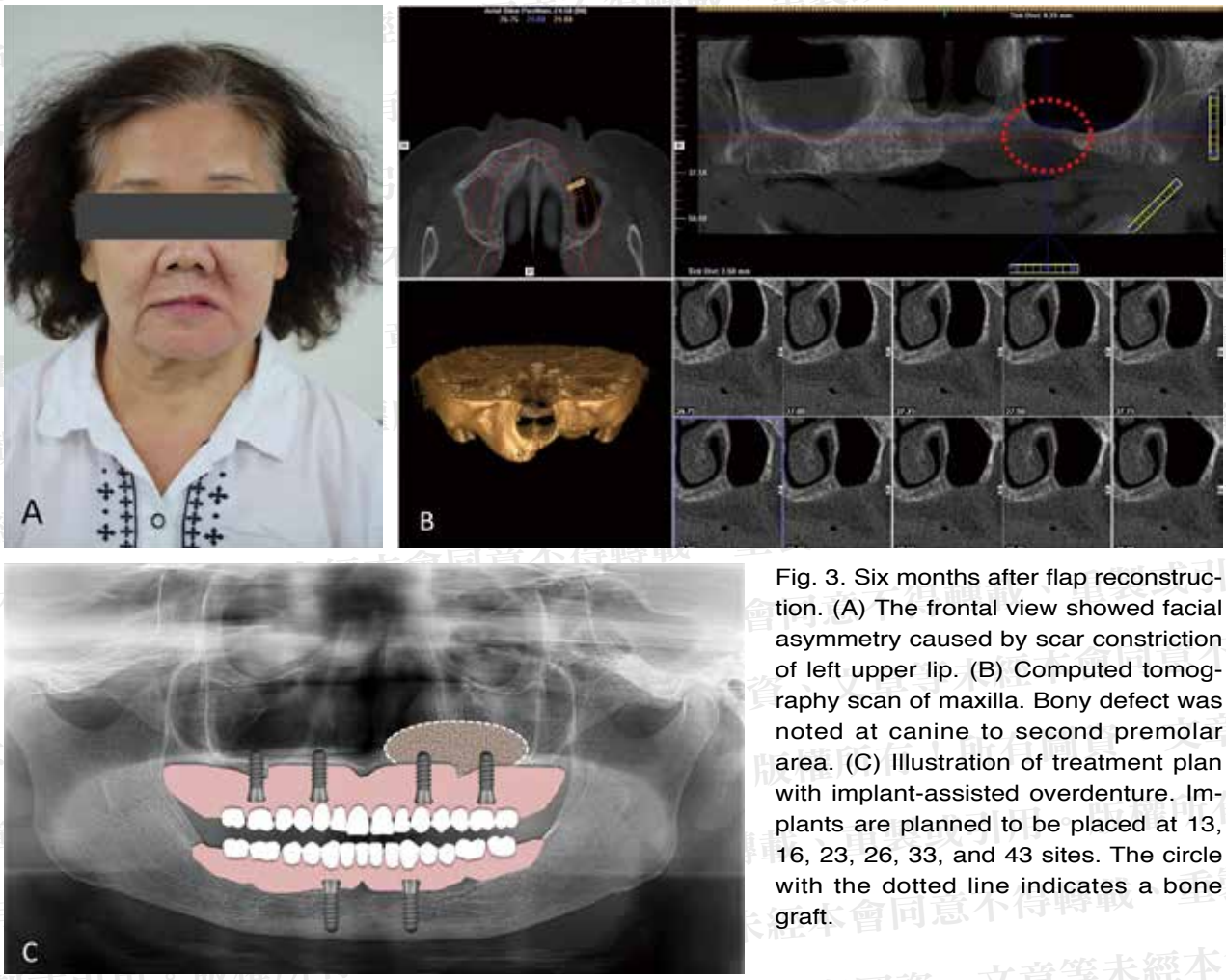

Fig. 3. Six months after flap reconstruction. (A) The frontal view showed facial asymmetry caused by scar constriction of left upper lip. (B) Computed tomography scan of maxilla. Bony defect was noted at canine to second premolar area. (C) Illustration of treatment plan with implant-assisted overdenture. Implants are planned to be placed at 13, 16, 23, 26, 33, and 43 sites. The circle with the dotted line indicates a bone graft.

suggested. The planned implant sites were 13, 16, 23, and 26 in the maxilla, and 33 and 43 in the mandible (Fig. 3C).

A staged treatment approach was conducted. The first stage consisted of a preparation stage for the flap revision. It included implant surgery for the 13, 16, 33, and 43 implant sites and complete denture fabrication. In the following revision surgery stage, the implant-retained maxillary denture would be fixed to the palate with Locator attachments and bone screws, and the denture would serve not only as a surgical stent but also as a masticatory apparatus during the one-month healing process.

The second stage consisted of the flap revision surgery itself. The entire flap margin except the labial margin was revealed, and the revealed flap was elevated and pushed out toward the labial-buccal direction to serve as the new labial and buccal mucosal lining, whereas the palatal wound was left to heal secondarily.

The third stage will consist of sinus floor elevation and implant placement at the 23 and 26 sites. After osseointegration, the upper denture will be readjusted to pick up the Locator metal housing of the 23 26 site implants, and the full-mouth complete dentures retained by the implant attachments (four in the maxilla and two in the mandible) will serve as the definitive prosthesis.

The first stage: implant placement over 13, 16, 33, and 43 sites and fabrication of complete dentures.

Three months after the implant placement, the patient was referred to the prosthodontic department for fabrication of the complete dentures. Clinical examination revealed fully edentulous maxillary and mandibular ridges, with 4 implants placed at the 13, 16, 33, and 43 positions. The implants at the 13 and 16 positions were Ø4.1 mm and 12 mm in length (Bone level implant, Regular CrossFit Connection, Straumann®), and the implants at the 33 and 43 positions were Ø4.1 mm and 10 mm in length (Standard plus, Regular Neck, Straumann®)

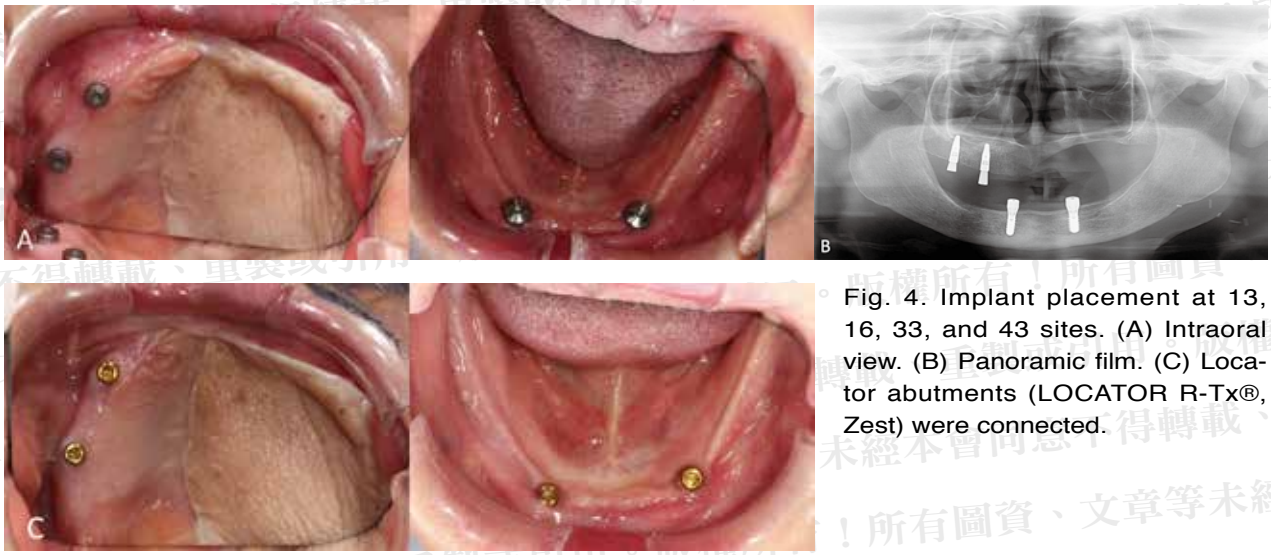

Fig. 4. Implant placement at 13, 16, 33, and 43 sites. (A) Intraoral view. (B) Panoramic film. (C) Locator abutments (LOCATOR R-Tx®, Zest) were connected.

(Fig. 4A, Fig. 4B).

The fabrication of the implant-assisted overdenture was soon completed. Locator abutments (LOCATOR R-Tx®, Zest) were connected to the fixtures with 35 Ncm torque (Fig. 4C). Individual trays were used to make the final impression with additional type silicon impression material (Exadenture, GC Co. Tokyo, Japan). A series of processes including taking the vertical dimension, bite registration, and wax denture try-in were performed, with the aim of achieving bilateral balanced occlusion(Fig. 5).

At the delivery appointment, the dentures were first roughly adjusted to allow the patient to occlude without denture rocking. Then the areas opposite the Locator abutments were relieved and small escape holes were drilled, and the metal housings

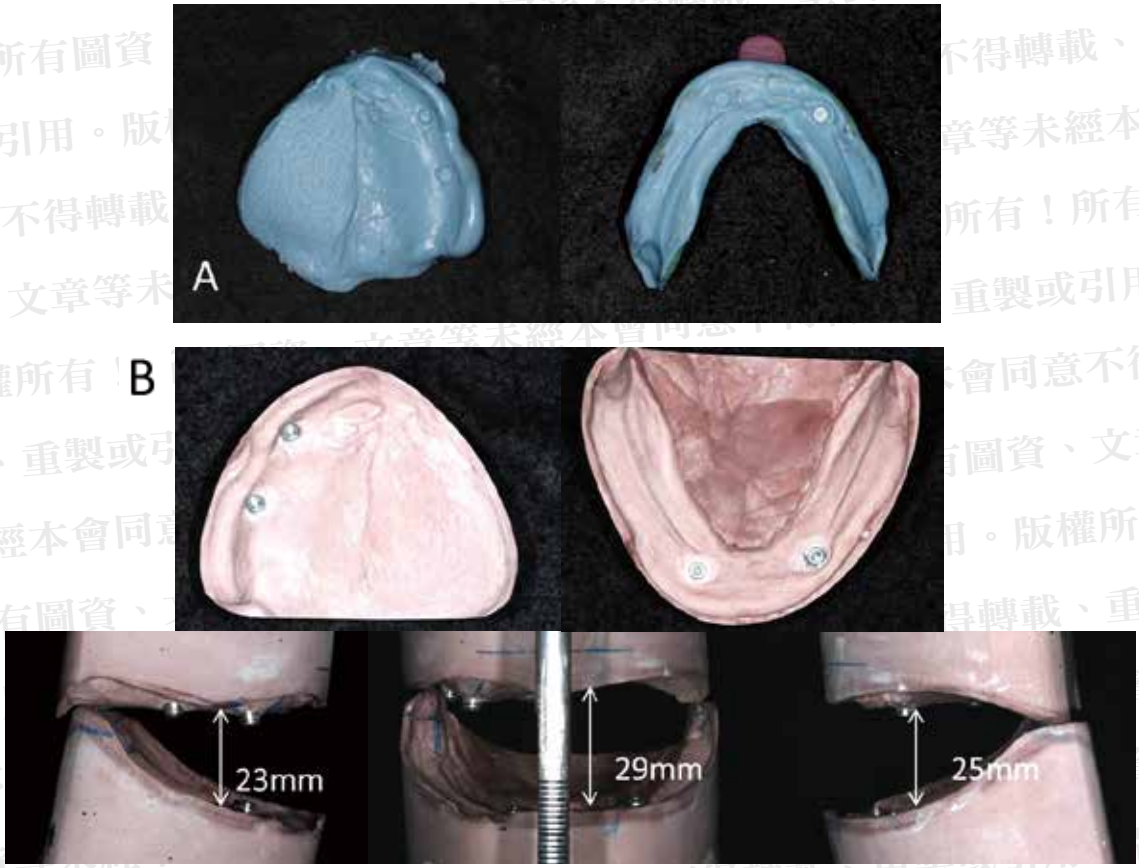

Fig. 5. Processes of denture fabrication. (A) Final impression. (B) Master cast on articulator. (C) Wax dentures. (D) Intraoral view with new dentures. Bilateral balanced occlusion was effectively achieved. (E) Extraoral view with new dentures.

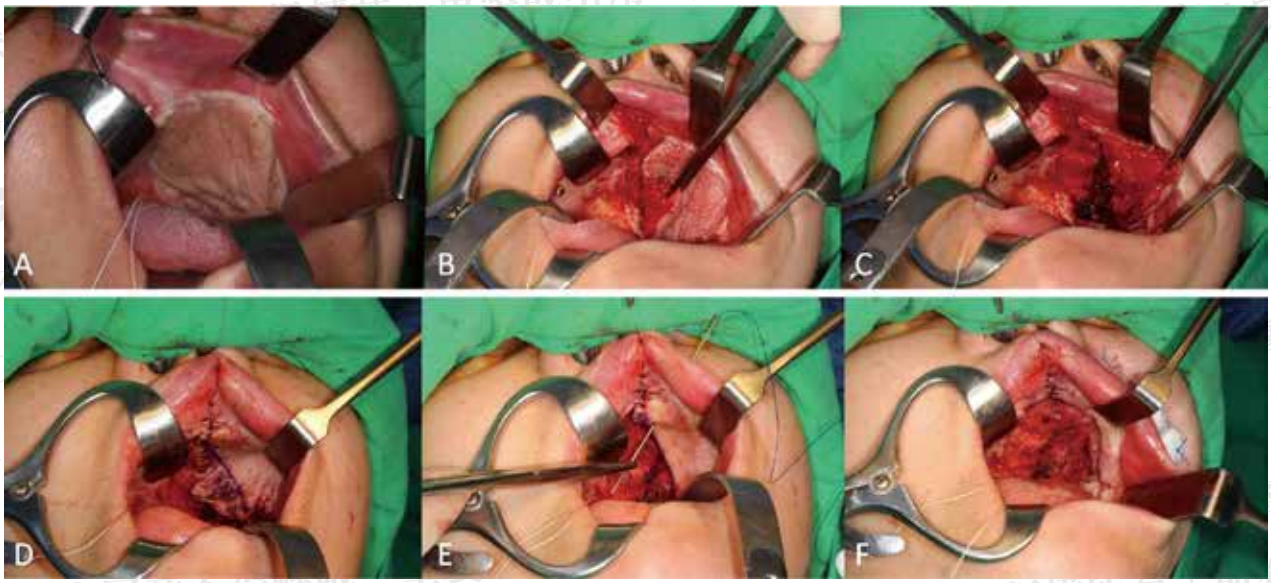

Fig. 6. Free flap revision. (A) Intraoral view before revision surgery. (B) The flap was lifted from palate. (C) The fatty tissue underneath was exposed then removed. (D) Extra part of the flap was marked and excised. (E) The lifted flap was transported to labial-buccal area and fixed trans-facially with straight needle and 2-0 prolene. (F) Intraoral view after flap transposition.

Fig. 7. Denture relining. (A) The correct position of maxillary denture was checked again. (B, C, D) The left part of the denture was relined with self-cured, hard denture reline material. (E, F) The denture was fixated with bone screws. (G) The occlusion of the dentures was checked again.

were picked up with self-cure acrylic (UNIFAST™ TRAD, GC) at chairside. The mandibular denture was processed first, followed by the maxillary denture. The patient was told to close her denture teeth together when we picked up the metal housing. The occlusion of the dentures was checked and adjusted again after the pick-up procedure.

Since the left anterior border of the maxillary denture was affected by the scarring of the skin flap around the 23-25 area, the denture had no labial and buccal flange at this time.

The second stage, part 1: free flap revision using complete dentures as a compression splint

After the denture delivery, the patient was closely monitored for one month to ensure that she was doing well with the new dentures. The flap revision was then arranged on 2018-01-03.

With the patient under general anesthesia, the bulky flap was carefully lifted from the palate, and the fatty tissue was removed. The lifted flap was transported to the labial buccal area and fixed by trans-facial fixation using 2-0 prolene carried by a straight needle. This procedure was intended to create the vestibule part of the left maxilla, which was previously covered by a soft and mobile skin flap. The flap transposition also allowed the surface of the

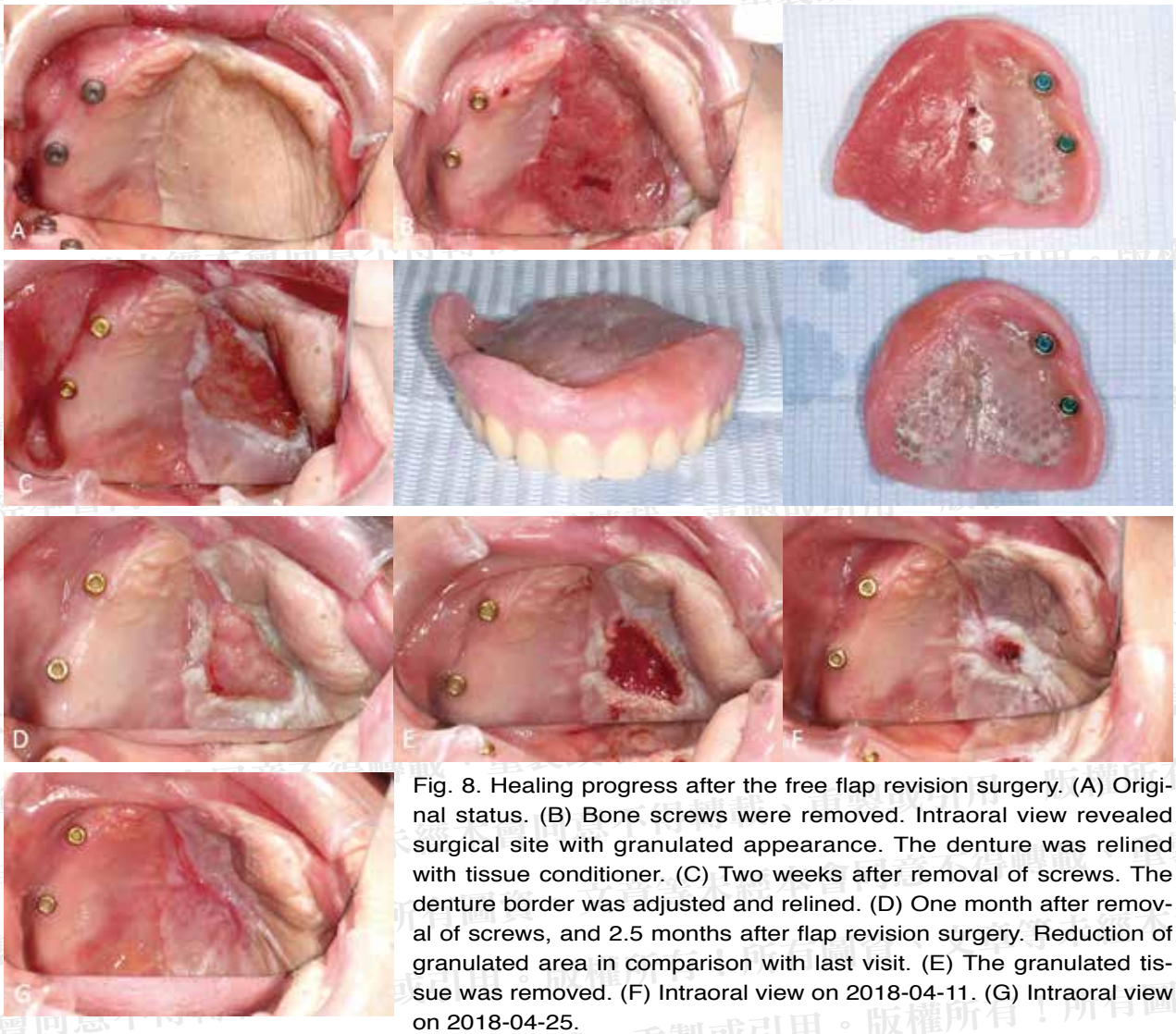

Fig. 8. Healing progress after the free flap revision surgery. (A) Original status. (B) Bone screws were removed. Intraoral view revealed surgical site with granulated appearance. The denture was relined with tissue conditioner. (C) Two weeks after removal of screws. The denture border was adjusted and relined. (D) One month after removal of screws, and 2.5 months after flap revision surgery. Reduction of granulated area in comparison with last visit. (E) The granulated tissue was removed. (F) Intraoral view on 2018-04-11. (G) Intraoral view on 2018-04-25.

hard palate and the alveolar ridge to be exposed for secondary healing (Fig. 6).

The surgical site of the denture was then relined with self-cured, hard denture reline material (Tokuyama® Rebase II) to compensate for the loss of great volume after the flap transposition. Considering that the denture would be fixated intraorally for at least one month, the hard reline material was chosen instead of soft reline material to reduce the possibility of contamination in the oral environment. Moreover, the Locators at the 13 and 16 positions and the right part of the palate helped to retain and locate the denture intraorally. Then, two bone screws were used to fixate the denture onto the hard palate (Fig. 7).

The second stage, part 2: status after lateralization of free flap; secondary healing of palate and mucosalization

Regular follow-up appointments were scheduled for every one or two weeks after the surgery. On 2018-02-21, the screws were removed, and the tissue underneath the denture showed redness and a granulated appearance as it proceeded through the secondary wound healing process. The denture was then adjusted and relined with tissue conditioner (Tempo™ tissue conditioner, Lang Dental Mfg Co Inc.) at the same appointment (Fig. 8A, Fig. 8B).

Two weeks later, the soft tissue was still undergoing the normal healing process. However, the patient had difficulty in wearing the denture and was scared by the mild oozing of the surgical site, so she did not wear the prostheses for 2 weeks. Scar contraction of left buccal border was noted. The denture was adjusted, and the tissue conditioner was replaced (Fig. 8C). On 2018-03-21, intraoral examination revealed reduction of the granulated

area. The granulated tissue was removed to allow the surrounding mucosa to grow in (Fig. 8D, Fig. 8E).

At the follow-up appointment on 2018-04-11, continuous reduction of the granulated area was observed. On 2018-04-25, intraoral examination revealed a great result in terms of the tissue healing of the left palate (Fig. 8F, Fig. 8G).

Compared to the mobile fascopcutaneous flap, the newly grown soft tissue was firm and stable. The soft reline material was thus replaced with self-cured denture reline material (Tokuyama® Rebase II). As the patient adapts to the relined denture, the last two stages of the treatment, which will include left sinus floor elevation, implant placement at the 23 and 26 sites, and re-adjustment of the upper complete denture to fit the new attachments, will be performed.

Discussion

Palatal obturators and flap reconstruction have been commonly used in patients with acquired maxillary defects. However, there is still no consensus in terms of comparisons between the two methods. Those who advocate the use of obturator prostheses consider its advantages to include the shorter operating time, shorter post-operative hospital stay, and lower complication rate in comparison with flap reconstruction[2]. In addition, with an obturator, the defect itself may contribute to the support, stability, and retention of the prosthesis and may increase its success rate[1,6,7]. Moreover, the maxillectomy cavity can be completely visualized during follow-up appointments[6].

Still, there are some disadvantages to this technique, such as the potential for hypernasal speech, the regurgitation of foods and liquids into the nasal cavity, and the need for repeated prosthesis adjustments due to progressive changes in the size and shape of the palatal defect. Difficulty in maintaining the hygiene of the maxillectomy cavity may also cause inconvenience to the patient. Moreover, it is sometimes more difficult to use an obturator in patients who have acquired large palatal defects, as the prosthesis may be overly heavy and difficult or impossible to retain, particularly in partially or totally edentulous patients[2].

As such, surgical reconstruction of the palatal defect with the free flap also has some advantages, which include closure of the oral cavity[1], the reduction of speech and swallowing problems[6], and the provision of psychological benefits to the patient in terms of comfort, convenience, and social interactions.[4] Moreover, surveillance of the area can be performed with a nasoendoscope. In addition, computed tomography (CT) and magnetic resonance imaging (MRI) can also be used as monitoring tools[6].

Previous studies have compared obturator prostheses with flap reconstructions in terms of patient functions and quality of life[2-5]. Some studies have suggested that different methods can be chosen based on the defect size. Okay et al[1] provided a classification system that divided maxillary defects into three types, and established an algorithm for palatomaxillary reconstruction according to the defect type.

Defects that involved the hard palate but not the tooth-bearing alveolus were categorized as class Ia, while class Ib defects were defined as those involving the premaxilla or any portion of the maxillary alveolus and dentition posterior to the canines. Class I palatomaxillary defects can be rehabilitated with a prosthetic obturator or soft tissue to achieve optimal orodental restoration. Soft tissue reconstruction can be achieved with either a local advancement flap or a fasciocutaneous free flap. Class II defects that involve an ipsilateral single canine can be rehabilitated with an obturator prosthesis or a vascularized bone-containing free flap (VBCFF). In contrast, class III defects involving more than 50% of the hard palate can be better managed with a VBCFF. The bone-containing free flap can re-establish the alveolar arch, and can provide a stable base for function and implant prosthodontics.

Moreno et al.[2] concluded that moderate-sized maxillectomy defects involving the palate can be successfully treated with either an obturator or free flap reconstruction. Extensive defects have a better functional outcome with free flaps. However, in the study by Genden et al.[4], the authors concluded that free flap reconstructions improve patient quality of life and function more effectively than an obturator prostheses, even in patients with small and medium size defects of the hard palate.

In our case, the patient had been edentulous for more than 30 years, and the maxillary ridge was thin. Oro-nasal communication was thus observed at the left anterior area after partial maxillectomy. Although immediate flap reconstruction separated the oral and nasal cavities and spared the patient from any possible inconvenience, its mobility and scar constriction have made the fabrication of complete dentures difficult. Even with the help of implants, the stability and retention of the complete dentures are still unfavorable due to the fatty tissue contained in the free flap.

From the previous study by Badran et al.[9], we knew that even though the epithelium of the flap may sometimes change to resemble normal buccal epithelium, the underlying connective tissue will retain the structure of dermis, and will not represent a truly permanent change in epithelial type. Simply removing the fat from the flap might reduce the vol-

ume and softness of the flap to some degree, but the mobility of the skin surface would still affect denture stability. Futhermore, it would be hard to maintain the hygiene of the implants which are currently planned to be placed at the 23 and 26 sites.

In order to create a firm and stable denture-bearing area, we performed a second flap revision surgery with the assistance of a denture prosthesis. During this surgery, the excessive part of the flap covering hard palate was cut off, and the remaining part of the flap was defatted and attached to the buccal side. This procedure transported the mobile part of the flap to the buccal cheek to improve the denture retention and stability. The surface of the left palate was left exposed in the oral cavity for secondary healing, and the complete denture fabricated at the previous stage was used as a surgical stent to protect the palate from irritation. Also, fixating the denture to the palate would help keep the transported flap in position and, to some degree, prevent scar constriction so that the denture-bearing area created could be maintained. The case report of Dexter et al.[6] discussed a similar method of fixing an old denture as a surgical stent. In contrast with our case, however, Dexter simultaneously used the denture in the maxillectomy and flap reconstruction surgery. In both cases, the denture served as a transitional surgical stent, or obturator. The denture was then relined with soft liner after the screws were removed, and then relined again with self-cured hard relining acrylic material after the soft tissue healed.

In the case reported herein, the healed palatal mucosa now shows a firm and stable appearance and is adequate for future denture bearing. The prosthetic-assistance method used thus constitutes a promising procedure for tissue management after free flap reconstruction and could provide not only a more stable denture-bearing area but also better quality of life during the transitional stage.

This clinical case report illustrated an interdisciplinary treatment provided via cooperation between a prosthodontic surgeon and an oral surgeon. Although further bone augmentation and implant placement have yet to be conducted, the progress completed thus far indicates that the method used was successful in improving denture stability at the flap reconstruction area.

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