STM JOURNALS

Research & Reviews: A Journal of
Dentistry

https://journals.stmjournals.com/rrjod/

ISSN: 2230-8008 (Online)
ISSN: 2348-9561 (Print)
Volume 16, Issue 2, 2025
May–August
DOI (Journal): 10.37591/RRJoD

Case Report RRJoD

Mandible Reconstruction Following Resection of Gingival Squamous Cell Carcinoma with Peroneal Artery Perforator Based Fibular Osteocutaneous Free Flap

Sang Bong Ri[1,*], Song Hyon Kim[1], Jun Song Ryu[1], Hyon Il So[2], Chang Gol Rim[1]

Abstract

Reconstructing soft tissue defect resulting from resection of malignant tumor in face is crucial in esthetic and functional point of view. To address this condition, various surgical flaps are used, including the free vascularized osteocutaneous flap. In this case, we used a free fibular osteocutaneous flap to reconstruct both the bone (osseous) and soft tissue (mucosal) defects. These defects were caused by the removal (resection) of a lesion in a patient diagnosed with gingival squamous cell carcinoma that had spread to the mandible (lower jaw) and cervical lymph nodes. The fibular flap, taken from the leg, includes bone, skin, and blood vessels, making it ideal for reconstructing complex areas where both bone and soft tissue need to be replaced. This type of flap provides good structural support and healing, restoring function and appearance after extensive tumor removal. Using microvascular surgery, the flap's blood supply is reconnected to vessels in the neck, ensuring the survival of the transplanted tissue and helping the patient recover both aesthetically and functionally.

Keywords: Gingival carcinoma, peroneal artery perforator, osteocutaneous flap, mandibular reconstruction, lesion resection

INTRODUCTION

Gingival squamous cell carcinoma is a malignant tumor that can invade adjacent structures, including the mandible and cervical lymph nodes, especially in advanced stages. When the tumor infiltrates the mandible, both functional and aesthetic complications can arise, significantly affecting the patient's quality of life. In such advanced cases, a multidisciplinary surgical approach is often required to achieve oncologic control while also ensuring effective reconstruction of both soft tissue and bone defects. With advancements in microsurgical techniques, vascularized composite tissue flaps have become essential tools in complex head and neck reconstructions. Among them, the free fibular osteocutaneous flap is widely accepted as a reliable option for mandibular reconstruction due to its favorable anatomy, sufficient bone length, and robust vascular supply. It allows simultaneous reconstruction of osseous and mucosal defects, providing both structural stability and soft tissue coverage. This paper presents a case of a 60-year-old male patient with stage IV (T4aN1M0) gingival squamous cell carcinoma invading the mandible and cervical lymph nodes. We describe in detail the surgical resection of the tumor and the reconstruction procedure using a free fibular osteocutaneous flap, highlighting the surgical techniques, postoperative outcomes, and benefits of this method in restoring function and appearance after extensive resection in advanced oral malignancy.

***Author for Correspondence**
Sang Bong Ri
E-mail: cioc13@ryongnamsan.edu.kp

[1]Researcher, Department of Plastic Surgery, Pyongyang General Hospital, DPR Korea, Pyongyang, North Korea
[2]Senior Doctor, Department of Maxillofacial Surgery, Pyongyang General Hospital, DPR Korea, Pyongyang, North Korea

Received Date: January 08, 2025
Accepted Date: April 04, 2025
Published Date: May 05, 2025

Citation: Sang Bong Ri, Song Hyon Kim, Jun Song Ryu, Hyon Il So, Chang Gol Rim. Mandible Reconstruction Following Resection of Gingival Squamous Cell Carcinoma with Peroneal Artery Perforator Based Fibular Osteocutaneous Free Flap. Research & Reviews: A Journal of Dentistry. 2025; 16(2): 12–18p.

SURGICAL PROCEDURE

We are describing the procedure in a 60-year-old male patient with stage IV (T4aN1M0) gingival squamous cell carcinoma. On inspection, left mandibular region is slightly protruded and tumor invaded left mandible on 3D CT scan and MRI (Figures 1–3).

Figure 1. Preoperative photograph. (a) On inspection left mandible is slightly protruded, (b) Gingival lesion (blue dashed line).

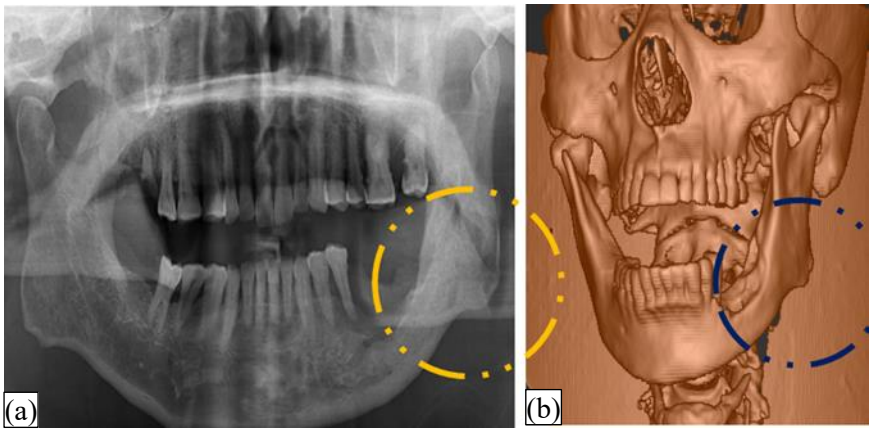

Figure 2. Preoperative X-ray (a) and 3D CT image, (b) (yellow and blue dashed lines: tumor lesion).

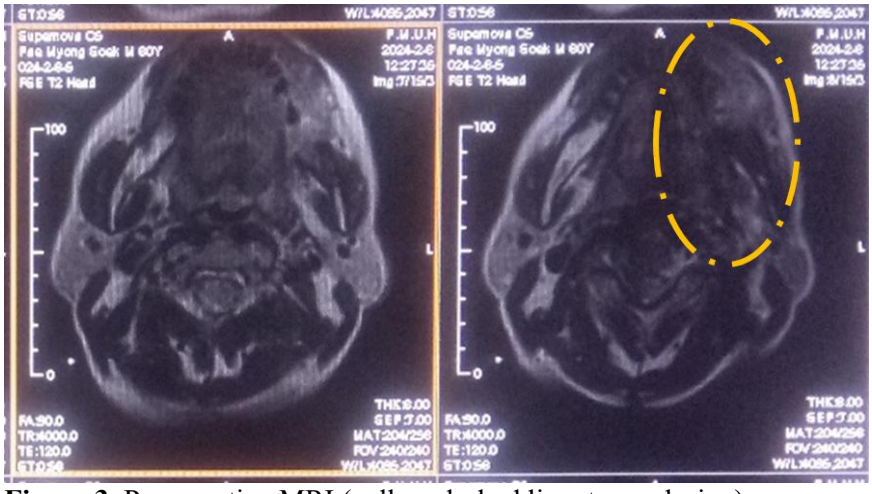

Figure 3. Preoperative MRI (yellow dashed line: tumor lesion).

The operation was performed by 2 teams to resect lesion and harvest fibular osteocutaneous flap based on peroneal artery perforator simultaneously. Under general anesthesia, oral mucosa, mandible and masseter suspected tumor invasion were resected en bloc with size 12 × 6 × 6 cm and lymph nodes of neck were totally resected to prevent metastasis of tumor through lymph node. Thorough hemostasis was done by ligation of vessels and facial artery, it is concomitant vein and external jugular vein were prepped for recipient vessels (Figures 4–7).

Figure 4. Specimen after surgical resection.

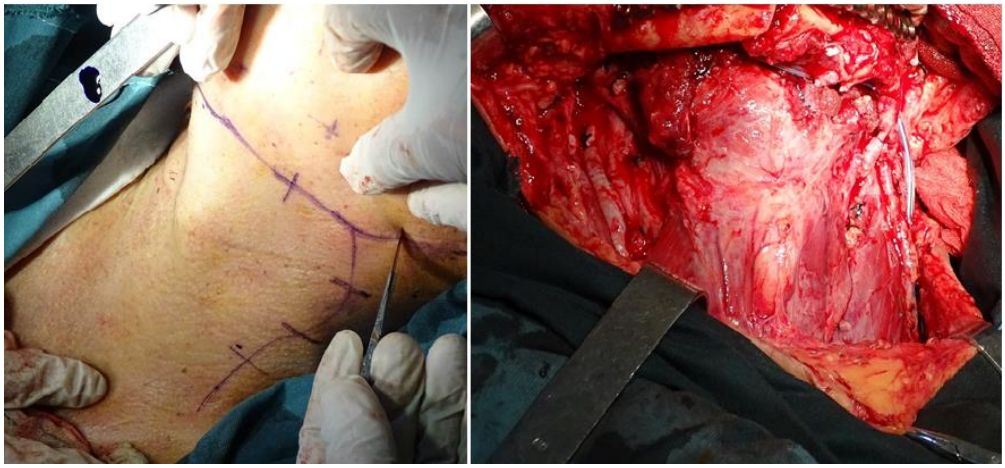

Figure 5. Lymphadenectomy on both sides of neck.

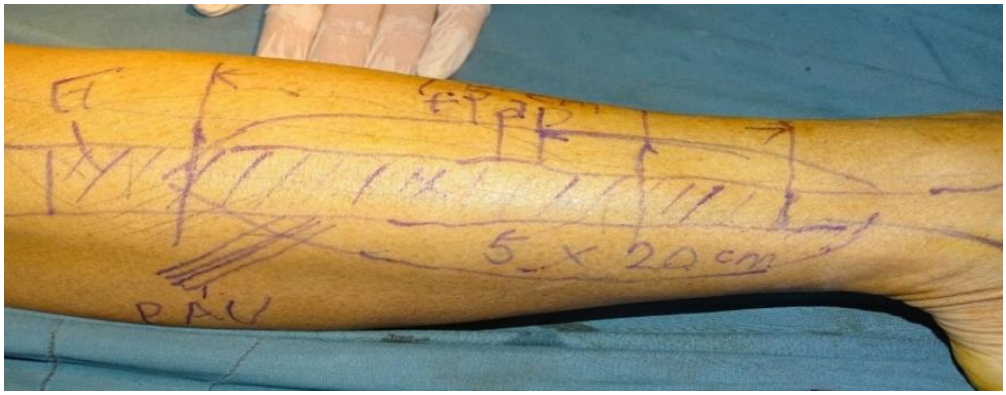

Figure 6. Fibular osteocutaneous flap design.

Figure 7. Fibula osteocutaneous flap.

We harvested fibular osteocutaneous flap in right leg. The posterior margin of skin island was incised first and extended down with sharp dissection identifying perforator vessels and preserving it. Dissection then proceeded from the lower part of fibular in an anterior direction leaving a cuff of muscle attached to surface of fibula. The peroneal artery and two Venae comitantes were dissected all the way to their origin from the posterior tibial artery and vein. The skin island was harvested with size 5 × 20 cm in the middle third of lower leg and fibula was harvested 25 cm long while preserving fibula 10 cm proximally and 10 cm distally. The vascular pedicle length was 10 cm. After elevating osteocutaneous flap completely sutured skin island in situ temporarily and deflated tourniquet. Circulation to skin island was good (Figure 8).

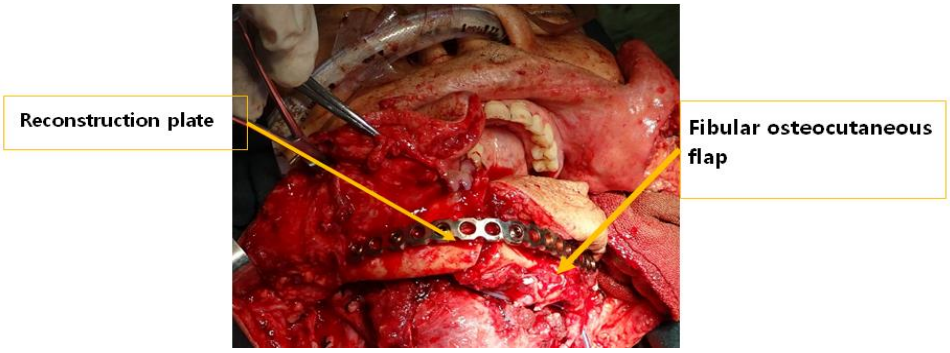

Figure 8. Fixation of fibula by reconstruction plate.

After preparation of recipient site, separated osteocutaneosu flap and bone graft was fixed to recipient mandible by means of reconstruction plate. The peroneal artery of the harvested fibular flap was carefully anastomosed to the facial artery using end-to-end microvascular technique to ensure optimal blood flow to the transplanted tissue. Additionally, the two vena comitantes accompanying the peroneal artery were each anastomosed respectively to the facial vein and the external jugular vein, also in an end-to-end fashion, to establish adequate venous drainage. After confirming good vascular circulation to the flap, the skin island of the flap was meticulously sutured to the oral mucosa to reconstruct the intraoral soft tissue defect. The donor site on the leg, from where the fibular flap was harvested, was closed using a full-thick skin graft to promote healing and minimize morbidity. This careful closure ensured functional recovery at the donor site while preserving cosmetic appearance and mobility of the lower limb. The vascular connections and soft tissue integration were verified intraoperatively to ensure long-term success of the reconstruction (Figures 9–12).

Figure 9. Intraoperative photograph showing inset of flap.

Figure 10. Intraoperative photograph showing donor site closure with skin graft.

Figure 11. Postoperative X-ray (30th postoperative day).

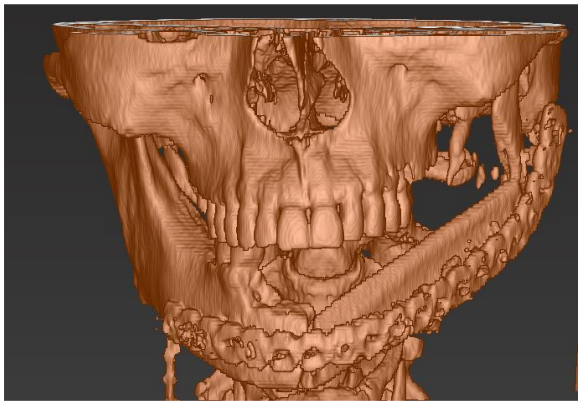

Figure 12. Postoperative 3D CT view (2 months postoperative day).

DISCUSSION

In the treatment of malignant tumor of face, radically resecting lesion and reconstructing soft tissue defects as well as chemotherapy and radiation therapy are very important in elongating life and improving quality of life [1, 2]. In the mandible, large bone defects may lead to functional impairment affecting swallowing or speech and causing esthetic deformities. With the development of microsurgical techniques to harvest vascularized bone grafts, many researchers consider the fibula flap the workhorse for reconstructing large segmental mandible defects [3–5]. The fibula flap offers numerous advantages that make it a preferred choice for mandibular reconstruction, particularly in complex head and neck surgeries. One of its most notable features is its naturally straight shape, which closely resembles the contour of the mandible, making it structurally ideal for reconstruction. It possesses high mechanical strength and demonstrates excellent resistance to both pressure and torsional forces, contributing to long-term stability after reconstruction. The fibula bone has a high cortical content, which enhances its durability and integration with the surrounding tissue. Due to its rich vascular supply, the flap exhibits rapid healing and incorporation once transplanted. Additionally, the fibula provides sufficient length, enabling the reconstruction of extensive defects without compromising structural integrity. It can be osteotomized at multiple points to match the anatomical requirements of the defect, offering great flexibility in surgical design. The flap can be harvested relatively easily, with well-sized and consistent blood vessels suitable for microsurgical anastomosis. Moreover, it causes minimal donor site morbidity and can be harvested with an attached skin paddle and muscle, forming an osteomyocutaneous flap that allows simultaneous reconstruction of both bone and soft tissue. These combined advantages make the fibular flap a versatile and reliable option in reconstructive surgery [6–10].

Adequate chemotherapy and radiation therapy, when effectively combined with thorough surgical resection of the tumor, play a critical role in the comprehensive management of end-stage oral cancers. However, successful treatment outcomes also depend on precise and delicate microsurgical reconstruction techniques. The use of a free vascularized fibular osteocutaneous flap has proven to be highly effective in such complex cases. This flap allows for simultaneous restoration of both bone and soft tissue defects, offering structural support and functional recovery. When performed correctly, this approach significantly improves survival, rehabilitation, and quality of life in patients with advanced-stage malignancies.

CONCLUSIONS

In this case, we successfully managed an advanced stage (Stage IV, T4aN1M0) gingival squamous cell carcinoma by performing a thorough surgical resection followed by immediate reconstruction using a free fibular osteocutaneous flap. The tumor had invaded the mandible and cervical lymph nodes, requiring en bloc removal of the affected mandible, soft tissue, and lymphatic structures. For reconstruction, the fibula flap provided a reliable and effective option, allowing us to restore both the bony framework and oral mucosa in a single-stage procedure.

This surgical approach not only ensured complete tumor removal but also addressed the resulting large composite defect. The fibular flap was advantageous due to its long bone length, strong vascular supply, and ability to be shaped according to the defect. Through microvascular anastomosis, we achieved good perfusion, and postoperative imaging confirmed successful integration of the graft.

In conclusion, the combination of radical tumor resection with free fibular osteocutaneous flap reconstruction can offer promising outcomes in terms of function, aesthetics, and overall quality of life, even in end-stage oral cancers. This method proves to be a valuable reconstructive technique in head and neck oncologic surgery.

REFERENCES

1. Robey AB, Spann ML, Ogle RC, Fernandes R. Comparison of miniplates and reconstruction plates in fibular flap reconstruction of the mandible. Plast Reconstr Surg. 2008 Dec;122(6):1733–8.

2. Hölzle F, Kesting MR, Hölzle S, Rohleder NH, Wolff KD. Clinical outcome and patient satisfaction after mandibular reconstruction with free fibula flaps. Int J Oral Maxillofac Surg. 2007 Aug;36(8):802–6.
3. López-Arcas JM, Arias J, Barajas M, Gutiérrez-Pérez JL. The fibula osteomyocutaneous flap for mandible reconstruction: a 15-year experience. J Oral Maxillofac Surg. 2010 Nov;68(11):2377–84.
4. Kessler P, Neukam FW, Wiltfang J. The role of angiography in the lower extremity using free vascularized fibular transplants for mandibular reconstruction. J Craniomaxillofac Surg. 2001 Oct;29(5):332–6.
5. Rogers SN, Lowe D, McNally D, Brown JS, Vaughan ED. Health-related quality of life after mandibular resection for oral cancer: a comparison of reconstructive techniques. Head Neck. 2003 Dec;25(12):976–84.
6. Shaw RJ, Kanatas AN, Lowe D, Brown JS, Rogers SN, Vaughan ED. Comparison of miniplates and reconstruction plates in mandibular reconstruction. Head Neck. 2004 May;26(5):456–63.
7. Hidalgo DA, Pusic AL. Free-flap mandibular reconstruction: a 10-year follow-up study. Plast Reconstr Surg. 2002 Jul;110(2):438–49.
8. Farwell DG, Kezirian EJ, Heydt JL, Yueh B, Futran ND. Efficacy of small reconstruction plates in vascularized bone graft mandibular reconstruction. Head Neck. 2006 Jul;28(7):573–9.
9. Hidalgo DA. Fibula free flap: a new method of mandible reconstruction. Plast Reconstr Surg. 1989 Jul;84(1):71–9.
10. Cordeiro PG, Disa JJ, Hidalgo DA, Hu QY. Reconstruction of the mandible with osseous free flaps: a 10-year experience with 150 consecutive patients. Plast Reconstr Surg. 1999 Mar;104(5):1314–20.

