

Simplifying the Combined Use of Fibula Flap and Anterolateral Thigh Flap for Oromandibular Reconstruction

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Summary: Although the preferred technique for reconstruction of extensive composite oromandibular defects involves the use of a fibula flap for the inner mucosal lining and mandibular bone reconstruction and an anterolateral thigh flap for outer skin coverage and soft tissue replenishment, this approach is complicated and manpower-dependent. It also often involves prolonged operations requiring nighttime surgery with insufficient manpower in an era of restricted working hours for residents, which can negatively affect the surgical outcomes. Traditionally, the mucosal defect is first defined and the fibula flap is then dissected to ensure a size-matching skin flap for the inner lining. This flap is transferred first after mandibulectomy is completed, but is delayed by the fibula bone shaping process. Finalizing the flap inset is a sophisticated process involving the fibula bone, fibula skin, and anterolateral thigh skin. Thus, we developed a strategy to overcome the late start of fibula flap harvest, the delayed initiation of defect-site reconstruction, and the troublesome flap inset. Briefly, we dissected both flaps sequentially or simultaneously from contralateral limbs before the mucosal defect was defined, so that the flaps were ready in the daytime. Once the mandibulectomy was completed, we transferred the anterolateral thigh flap first while the fibula bone was shaped, and simplified the flap inset by using the anterolateral thigh skin for the inner lining and outer coverage and the fibula skin as a monitoring flap. We employed this approach in five patients and completed postmandibulectomy reconstruction in as fast as 4 hours. (*Plast Reconstr Surg Glob Open* 2021;9:e3938; doi: [10.1097/GOX.0000000000003938](https://doi.org/10.1097/GOX.0000000000003938); Published online 16 November 2021.)

INTRODUCTION

The combination of a fibula flap and an anterolateral thigh flap is the standard approach for reconstructing extensive composite mandibular defects.¹ However, this technique is sophisticated, time-consuming, and manpower-dependent, often necessitating prolonged operations and nighttime surgeries, which is difficult, as the number of available surgeons and resident working hours are limited. This negatively affects the surgical outcomes.²⁻⁴ Therefore, we developed a strategy involving changes in the surgical sequence and redistribution of

flap components to complete both flap harvests before the completion of mandibulectomy, initiate the defect-site reconstruction immediately after mandibulectomy, and simplify the flap inset.

PATIENTS AND METHODS

Previously, harvesting of the fibula flap was started after defining the mucosal defect, which was followed by harvesting of the anterolateral thigh flap, usually from the same limb after removal of the thigh tourniquet. Once mandibulectomy was completed, the fibula bone was shaped. Then, the shaped fibula flap was transferred for the inner lining and mandibular reconstruction (Fig. 1), followed by transfer of the anterolateral thigh flap for the outer coverage and soft tissue replenishment.

The evolution of this strategy started with simplification of the flap-tissue arrangement, by placing the fibula skin flap as an optional monitoring flap and using the anterolateral thigh skin flap for the essential inner lining and outer coverage.⁵ This simplification has the added

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benefit of removing the need to wait for an evaluation of the mucosal defect before starting the fibula flap harvest, allowing both flaps to be harvested earlier to prepare them before completion of mandibulectomy. Later, we noticed that the defect-site reconstruction was delayed because of the fibula bone shaping process. Therefore, we transferred and revascularized the anterolateral thigh flap during this waiting period. These changes are organized into three time-oriented steps and summarized in Table 1.

Step 1: Complete the Harvest of Both Flaps before Completion of Mandibulectomy

We traditionally prepare one limb for harvesting both flaps, and the fibula flap is always harvested first. Moreover, the fibula flap harvest usually starts only after the mucosal defect is evaluated to facilitate identification of a size-matched skin flap for the inner lining. Here, because we no longer use fibula skin for the inner lining and intend to transfer the anterolateral thigh flap first, we now harvest the anterolateral thigh flap and the fibula flap earlier, sequentially or simultaneously from the contralateral limb, thus avoiding the chaos of using the thigh tourniquet over the anterolateral thigh flap. This approach helps obtain both flaps before the completion of mandibulectomy.

Step 2: Transfer the Anterolateral Thigh Flap First after the Mandibulectomy

After completion of the mandibulectomy, the dissected fibula flap can then be osteotomized and shaped to fit the mandibular defect, leaving the defect-site reconstruction without progress. The idea is to transfer the anterolateral

Takeaways

Question: Reconstruction of extensive composite oromandibular defects with a fibula flap for the inner mucosal lining and mandibular bone reconstruction and an anterolateral thigh flap for outer skin coverage and soft tissue replenishment is complicated, time-consuming, and manpower-dependent, necessitating prolonged operations and often requiring nighttime surgery with insufficient manpower in an era of restricted working hours.

Findings: By modifying the surgical sequence and redistributing the flap components, we developed a strategy to overcome the late start of fibula flap harvest, the delayed initiation of defect-site reconstruction, and the troublesome flap inset.

Meaning: Accomplishing post-mandibulectomy double-flap reconstruction within 4 hours is possible.

thigh flap first when the fibula bone is shaped. In practice, the anterolateral thigh flap is transferred and revascularized soon after mandibulectomy (Fig. 2). The shaped fibula flap is then transferred, fixed, and revascularized. This approach helps commence defect-site reconstruction immediately without being delayed by the fibula bone shaping process.

Step 3: Use the Anterolateral Thigh Skin Flap for Both the Inner Lining and Outer Coverage and the Fibula Skin Flap as a Monitoring Flap

Traditionally, both skin flaps are essential, and a third skin flap will be required if either flap fails. We

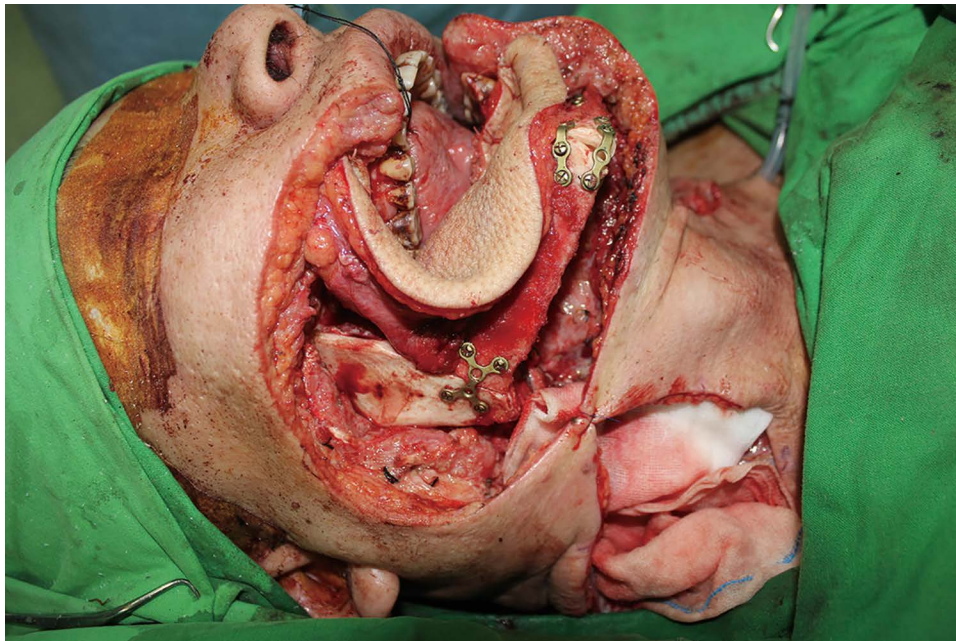


Fig. 1. Traditional double-flap reconstruction. The fibula flap was transferred first and its skin flap was used for inner mucosal lining. The remaining outer skin coverage and soft tissue replenishment were then reconstructed using the anterolateral thigh flap.

Table 1. Comparison between the Traditional and Modified Strategies in an Estimated Timeline of the Double-flap Reconstruction for Extensive Composite Oromandibular Defects

	Traditional	Modified
Tissue arrangement		
Fibula flap	Inner mucosal lining and mandibular reconstruction	Mandibular reconstruction
Anterolateral thigh flap	Outer skin coverage and soft tissue replenishment	Inner mucosal lining, outer skin coverage, and soft tissue replenishment
Surgical sequence		
13:00 ~		Harvest of the anterolateral thigh flap
15:00 ~	Harvest of the fibula flap	Harvest of the fibula flap
17:00 (completion of mandibulectomy) ~	Fibula bone shaping; harvest of the anterolateral thigh flap	Fibula bone shaping; transfer and revascularization of the anterolateral thigh flap
18:00 ~	Transfer and partial inset of the fibula flap	Partial inset of both flaps
19:00 ~	Revascularization of the fibula flap	Revascularization of the fibula flap
20:00 ~	Complete inset of the fibula flap	Complete inset of both flaps
21:00 ~	Transfer and partial inset of the anterolateral thigh flap	
22:00 ~	Revascularization of the anterolateral thigh flap	
23:00 ~	Complete inset of the anterolateral thigh flap	

now make only one skin flap essential, while the other is optional. Because the anterolateral thigh flap can provide a large reliable skin flap, it is used for both the inner lining and outer coverage, while the fibula skin flap is an optional monitoring flap (Fig. 3).⁵ With this approach, both flaps can be harvested before the mucosal defect is defined, and the process of finalizing the flap inset is also simplified.

DISCUSSION

In the new strategy, we start the anterolateral thigh flap harvest first and perform early fibula flap harvest sequentially or simultaneously from the contralateral

limb, and both procedures are completed before the completion of mandibulectomy. The anterolateral thigh flap is transferred and revascularized first, while the fibula bone is osteotomized and shaped. The simplified flap inset finalizes the reconstruction. We adopted this strategy in five patients (mean operative time, 6 hours 31 minutes; range, 3 hours 45 minutes to 7 hours 55 minutes).

Arguably, these steps are not obligatory. In step 1, it is not mandatory to harvest the anterolateral thigh flap first and use both limbs. We prefer to harvest the anterolateral thigh flap first because it is meant to be transferred first and is essentially responsible for wound healing, and we must ensure its reliability and availability beforehand. In step 2,

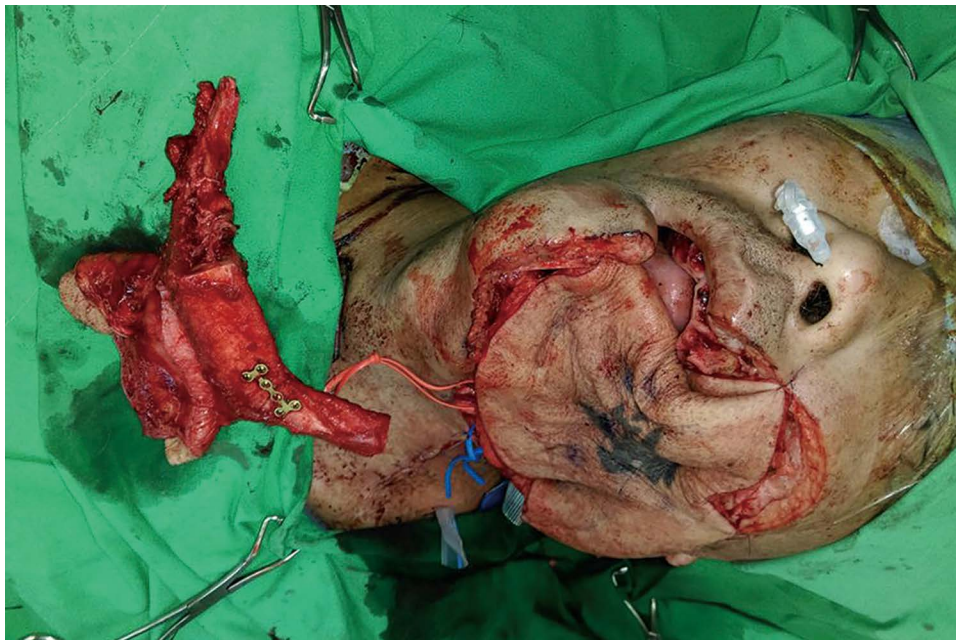


Fig. 2. Initiate anterolateral thigh flap transfer first in a modified sequence. The anterolateral thigh flap was transferred immediately after mandibulectomy was completed. Meanwhile, the fibula bone was osteotomized and shaped in the leg region. After revascularization of the anterolateral thigh flap to the transverse cervical vessels, it was secured at the lower neck region, and the shaped fibula flap was transferred for fixation and revascularization.



Fig. 3. Redistribution of the flap component. The anterolateral thigh skin flap (black asterisk) was used for both the inner mucosal lining and outer skin coverage, while the fibula skin (white asterisk) was merely used as a monitoring flap.

the use of computer-assisted design may facilitate the fibula bone shaping process before the completion of mandibulectomy, but this can only be achieved when the mandibulectomy is performed precisely as planned. In step 3, we could still use the fibula skin for the inner lining and start the harvest earlier before examining the mucosal defect by designing an oversized skin flap. However, the flap inset is not simplified, and an oversized harvest could be a waste.

Some limitations can make this strategy infeasible. First, the anterolateral thigh flap must have reliable cutaneous perforators to nourish a large skin flap that can be used for both the inner lining and outer coverage. Second, when one surgeon performs the microvascular anastomoses, another must be able to shape the fibula simultaneously. Third, fibula bone fixation may be disturbed by the transferred anterolateral thigh flap and distract the vascular pedicle accidentally. By using the transverse cervical vessels to revascularize the anterolateral thigh flap and secure the anterolateral thigh flap in the lower neck region, we avoided vascular pedicle injuries and difficulties in bone fixation.

In conclusion, our strategy overcomes the late start of fibula flap harvest, the delayed initiation of defect-site reconstruction, and the sophisticated flap inset. We believe it can simplify this complicated surgery, reduce the operating time, minimize the impact of reduced manpower in the nighttime, and reduce the surgeon's physical load and mental stress.

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