

# Peroneal perforator flap for intraoral reconstruction

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## Abstract

Thin and pliable flaps with long, high calibre pedicles are ideally suited to lining the inside of the mouth. The radial forearm free flap has been our flap of choice until now, but we are unhappy with its potential for complications at the donor site. As an alternative, 30 patients have been treated in our unit with peroneal perforator flaps. Magnetic resonance (MR) angiography is necessary preoperatively to identify major perforating vessels. Flaps were raised using a lateral approach after the position of the most suitable perforator had been marked on the skin. The skin flaps were outlined in the proximal half of the lower leg with a maximum width of 5 cm to allow for direct closure of the wound. Five patients (of the original 35) were excluded after the results of MR angiography were known. All perforators identified on MR angiography could be exposed in the proximal half of the lower leg and most had a septocutaneous course. Reconstructions were in the floor of the mouth ( $n=16$ ), tongue ( $n=11$ ), and buccal mucosa ( $n=3$ ). All but one flap survived with satisfactory functional results. The donor site morbidity was low. With the aid of MR angiography the peroneal perforator flap is a safe option for intraoral reconstruction. For small and medium sized defects we think that this flap is a good alternative to others, particularly if direct closure at an inconspicuous donor site is desired.

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**Keywords:** Perforator flap; Intraoral reconstruction; Lower leg; Peroneal vessels; Donor site morbidity

## Introduction

Intraoral defects are optimally repaired using thin, pliable flaps to reconstruct function and aesthetics, which provide the best replacement for the soft, mobile oral mucosa. The radial forearm flap has been the workhorse flap for maxillofacial surgeons since its introduction in the late 1970s despite it having several disadvantages, mainly concerning the donor site. There have been reports of complications at the donor site in 30–50%, mostly caused by the poor transplant bed for the split thickness skin graft.<sup>1,2</sup>

Other flaps that have been proposed for intraoral lining include the jejunal graft and the anterolateral thigh flap, each of which has its own limitations. Acceptance of the jejunal graft can be restricted by possible complications including adhesion-induced ileus, abdominal wall dehiscence, peritonitis, or hernias.<sup>3</sup> The mucosa of the jejunum is also vulnerable, and susceptible to mechanical loading. The anterolateral thigh flap is useful in thin patients, but is less suitable for intraoral lining in those of normal weight or fat. The flap can be thinned primarily to achieve results comparable to those of the radial forearm flap, but this requires a high degree of technical skill and exact knowledge of the vascular anatomy to avoid failure.<sup>4,5</sup>

We therefore looked for an alternative donor site, the primary aims being to raise a thin skin flap with a long, high-calibre pedicle and an inconspicuous scar with no functional consequences. Because of our experience in harvesting the osteocutaneous fibular transplant and the

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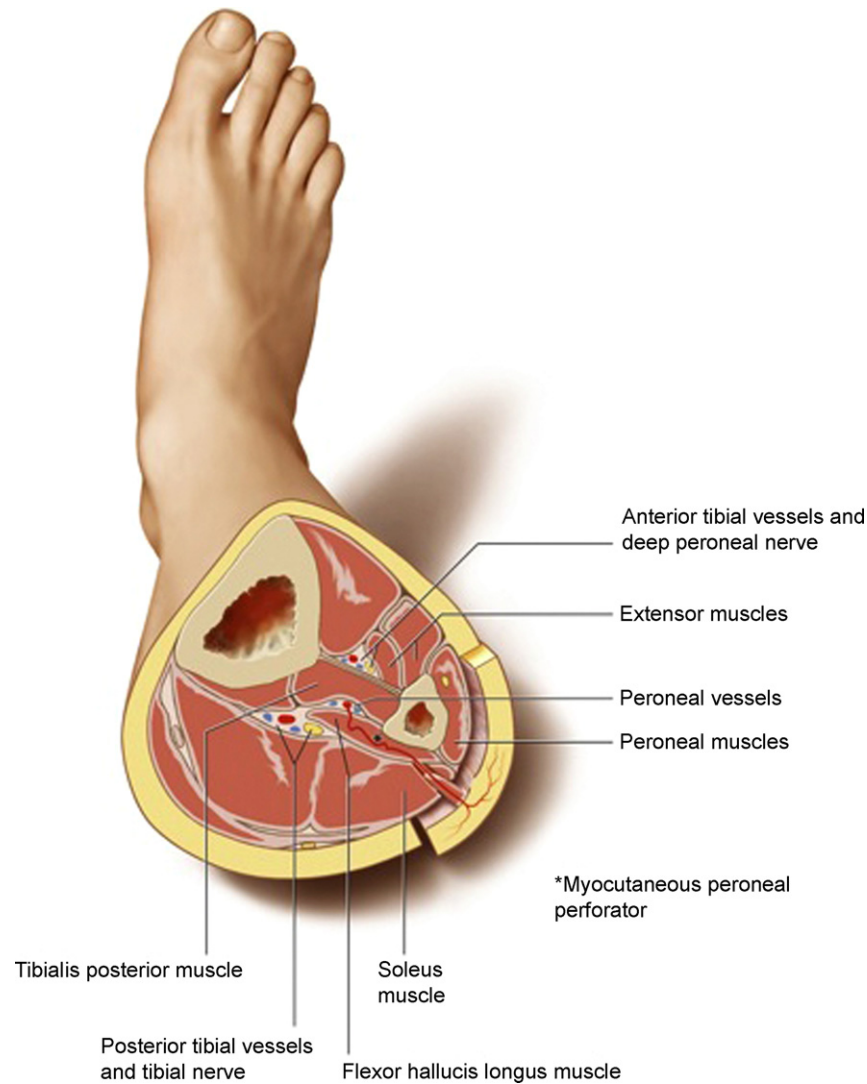


Fig. 1. Anatomy of the peroneal flap and its surrounding structures.

supramalleolar peroneal flap<sup>6,7</sup> we decided on the lateral lower leg as a donor site for a perforator-based skin flap (Fig. 1), and here we present a series of 30 patients.

### Patients and methods

Since January 2005, we have used the peroneal perforator flap to reconstruct intraoral defects in 30 patients. Twenty-nine had the flaps raised in conjunction with the primary resection of the tumour, and one had the reconstruction subsequently. All defects were soft tissue, intraoral defects with a maximum size of 4 cm × 7 cm (Table 1). Preoperative investigation involved clinical examination of the lower legs, specifically assessment of foot pulses, and we excluded those patients with varicosities or restricted walking ability. Patients with clinically healthy legs had high resolution MR angiography to assess the anatomy of the main vessels,

visualise side branches of the peroneal artery, and exclude arteriosclerotic damage (Fig. 1).

### Technique of magnetic resonance angiography

To achieve high-resolution imaging, the 3Tesla MRT Verio (Siemens) was used. The structures of the vessels were enhanced by injection of contrast medium (Magnograph, Schering) 18 ml, and the lower leg was scanned using the surface coil “Body Matrix” for 20 s. Multiplanar reconstructions were obtained from 88 slices with a Voxel resolution of 1 mm × 1 mm × 1 mm.

The peroneal perforators were assessed in both legs, and ideally a vessel would be identified in the proximal half of the lower leg with a diameter of at least 1.5 mm. Because MR angiography was not able to provide complete imaging of the side branches up to the skin, we did additional Doppler sonography along the posterior intermuscular septum. This was aided by using a ruler, which helped us to transfer the

Table 1

Details of 30 patients treated with the peroneal flap. Data are number of patients unless otherwise stated.

Variable	Number
<b>Patients</b>	
Male/female	21/9
Mean (SD) age (years)	67 (46–77)
<b>Indications</b>	
Squamous cell carcinoma	28
Mucoepidermoid carcinoma	1
Secondary reconstruction	1
<b>Reconstructions</b>	
Floor of mouth	16
Tongue	11
Buccal mucosa	3
<b>Type of perforator</b>	
Myocutaneous	9
Septocutaneous	21
<b>Complications</b>	
Loss of flap	1
Wound dehiscence	1
Skin graft required	1

distance between the side branch and the fibular head from the MR image to the skin (Fig. 2).

#### Raising the flap

The flap is raised without a tourniquet to allow us to assess the pulse and strength of the perforator to be used in the flap. The leg should be bent at the knee joint and externally rotated to gain better access to the posterior calf (Fig. 1). The skin is incised anteriorly to the posterior septum, which had been identified during preoperative measurement. After the cru-



Fig. 3. Deep flexor space with peroneal vessels and raised flap (same patient as in Fig. 2).

ral fascia has been opened the perforator is identified, and the lateral margin of the fibula can be palpated. The septum is incised around the perforator and detached from the fibula without any direct manipulation of the perforator. The pedicle is then followed by retrograde dissection until the peroneal vessels are reached, leaving a small cuff of the soleus muscle on both sides. The deep flexor space is opened with blunt detachment of the soleus and flexor hallucis muscles from the fibular bone. The peroneal vessels are readily identified and subsequently traced proximally until sufficient length is obtained for the pedicle (Fig. 3). The main vessels are then ligated distal to the perforator. An elliptical skin island is created, with its axis along the posterior septum and the perforator in the centre of the flap, and the flap is removed. The



Fig. 2. Preoperative magnetic resonance angiogram for evaluation of the main vessels and perforators in the lower leg. A ruler marks the distance between the head of the fibula and the perforator selected.



Fig. 4. Result of reconstruction of the tongue after 3 months.

donor site can be closed primarily after the adjacent tissue has been undermined.

## Results

MR angiography in 35 patients led to the exclusion of 5, one who had bilateral absence of the posterior tibial artery, and two who had severe arteriosclerotic damage. Another two patients had perforators originating from the iliotibial tract, or in the distal third of the leg, making direct closure impossible. We could not identify the exact course of the perforator using the MR angiograms, but its location at the skin and the length of the peroneal pedicle could be approximated. During operation subfascial exposure of the perforator corresponded well with the results of the mappings, and all perforators could be traced to their exit from the source artery. Pedicles varied in length from 6.5 to 11 cm (mean 9 cm). Twenty-one of the perforators travelled along the posterior intermuscular septum, and 9 followed a myocutaneous course through the flexor hallucis and soleus muscles. It was not possible to predict the type of perforator from the results of the MR angiogram.

Before the flap is sutured into the defect, the elliptical skin paddle is tailored to fit properly into the recipient site. The mean size of flap was 4 cm × 6 cm (range 2 cm × 4 cm to 5 cm × 9 cm). All peroneal perforator flaps were easy to anastomose because of the high calibre of the vessels (artery: 2–2.5 mm; veins: 3–5 mm).

Twenty-nine of 30 flaps survived, and all patients had intelligible speech and were able to eat a soft diet within 2 weeks. One flap was lost on day 4 because the arterial anastomosis ruptured. There were no functional restrictions at the donor site, and no patient complained about the appearance of the donor scar (Fig. 4). One patient required a 2 cm × 3 cm full-thickness skin graft to enable tension-free closure, and another developed an intraoral wound dehiscence that healed secondarily. All patients were satisfied with the results of their reconstructions, and no secondary measures (reduction in size of flap, or secondary thinning) were necessary (Fig. 5).



Fig. 5. The donor site after 2 weeks.

## Discussion

Although Yoshimura et al. previously described the possibility of raising cutaneous flaps on the peroneal vessels,<sup>8–10</sup> only a few authors have reported the indications for this flap in maxillofacial surgery. It has been used as a neurocutaneous flap incorporating the sural nerve for reconstructions of the hand and forearm<sup>11</sup> and for reconstructions of the oral cavity.<sup>7,12,13</sup> These studies reported only small numbers of patients, though all authors emphasised the usefulness of the thin and pliable skin of the lateral calf for covering superficial defects on the foot or hand, or for lining the oral cavity. The long, high-calibre vascular pedicle and the low donor site morbidity have been identified as further advantages of this flap, which led the authors to conclude that the peroneal flap is an adequate alternative to the radial forearm flap if an inconspicuous donor scar is important to the patient. Pre-operative evaluation is, however, essential because of the well-known anatomical variations and the increased risk if there is arteriosclerotic damage.

We used high-resolution MR angiography not only to confirm the presence of all three main vessels but also to visualise the side branches of the peroneal artery.<sup>14–17</sup> If no sizeable branch emerged from the peroneal artery along its upper half we concluded that no suitable perforator was present, and so we excluded those patients from having a peroneal flap. With this simple technique we were able to

predict the location of the perforator at the skin in all our patients. Despite earlier publications that described wide variability in the peroneal perforators, therefore,<sup>18–20</sup> the raising of skin flaps from the lateral calf can be considered reliable when the necessary preoperative investigations have been made. The evaluation of the pulse and size of the perforators, however, is only possible if the flap is raised from the perfused extremity. Although the perforators were evaluated preoperatively and located by MR angiography and Doppler, we consider that their intraoperative presence is most important for proper selection. All the patients in our series who passed the initial preoperative assessment had good pulses and perforators of adequate size at the time of operation.

Disadvantages over the forearm donor site include the need for MR angiography and the fact that the technique of raising the flap is more difficult, although exposure of the peroneal vessels with an intact fibula can be demanding when using the lateral approach. With adequate positioning of the leg, and full relaxation of the muscles, raising the flap will always be straightforward. The most important step is to gain safe access to the deep flexor space by bluntly and carefully detaching the soleus and flexor hallucis muscles from the posterior aspect of the fibula. This can be facilitated by curving the proximal skin incision posteriorly towards the knee joint.

Postoperatively these flaps fit well into the oral cavity and give good functional results. All our patients were able to swallow and to speak intelligibly, and there was no need for secondary thinning of the flap. The donor site morbidity was low, and there were no functional limitations at the time of discharge from the hospital. No patient complained about the aesthetic appearance of the donor scar.

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