B-ENT, 2015, **11**, 157-161

Superficial circumflex iliac artery perforator flap for reconstruction of oral defects after tumor resection

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Key-words. Superficial circumflex iliac artery perforator flap; SCIP; intra-oral reconstruction; head and neck cancer; free flap

Abstract. *Superficial circumflex iliac artery perforator flap for reconstruction of oral defects after tumor resection. Background*: The superficial circumflex iliac artery perforator (SCIP) flap, which is the most recent advance in free flap surgery, is described as an evolution of the conventional free groin flap. It has been applied to limb and penile reconstruction. The SCIP flap is versatile and has many advantages, but there are few reports on the application of the SCIP flap to head and neck defects.
Case report: We used a SCIP flap for reconstruction after resection of an oral malignant tumor in two women, aged 43 and 55 years, who presented between 2010 and 2012 with squamous cell carcinoma of the right floor of the mouth and tongue. After resection, the SCIP flap was elevated and used to reconstruct the defect Both flaps survived well.
Conclusions: We confirmed that the SCIP flap is an ideal thin, pliable, and reliable skin flap for reconstructing intra-oral soft-tissue defects with minimal donor-site morbidity.

Introduction

Perforator flaps in head and neck reconstruction

Free tissue transfer is currently the first choice for reconstruction of large or composite defects in head and neck reconstruction.[1] The superficial circumflex iliac artery perforator flap, also called the 'SCIP flap,' is an evolution of the conventional free groin flap. The latter, originally described in 1972 by McGregor and Jackson, was the first-ever successful free flap.[2] It was used successfully for lower-extremity reconstruction in 1973 by Daniel and Taylor.[3] The groin flap is based on the availability of the superficial circumflex iliac artery (SCIA). Initially, this free flap was very popular because of its many advantages.[4] Specifically, the donor site is concealed; mainly primary closure is possible; and a large hairless cutaneous flap can be harvested. However, there are some important shortcomings in that the arterial anatomy is variable, the pedicle is short, and the flap is quite bulky. This flap is rarely used today.

Since 1983, the radial forearm free flap is most often used for intra-oral reconstruction, although donor-site morbidity is problematic because of the poor scar following skin grafting, because a major artery to the hand is sacrificed, and because healing times are long in cases complicated by tendon exposure.[5]

In recent years, perforator flaps have become very popular. The major pedicle vessel has been replaced by a single perforating vessel that is used in continuity with a larger vascular stalk beneath the muscle. Due to better tissue preservation, there is reduced morbidity of the donor site and less pain for the patient, leading to reduced postoperative recovery time.[5] However, careful dissection is essential. Perforators may vary in size and position, which is why preoperative Doppler ultrasound is advisable.

The anterolateral thigh (ALT) flap is currently the most frequently used and the most reliable perforator flap for soft-tissue reconstruction in the head and neck.[5,6] In 1984, Song *et al*.[7] first described

Presented at The Annual Meeting of the Royal Belgian Society for Ear, Nose and Throat, Head and Neck Surgery, March 23, 2013, Brussels, Belgium.

this fasciocutaneous flap from the anterolateral region of the thigh, which is based on the descending branch of the lateral circumflex artery. Its versatility is well established: ALT flaps have all the advantages of forearm flaps, but morbidity at the donor site, which is almost always primarily closed, is lower, enabling larger reconstructions.[6] In many centers, this has become the flap of choice for skin and soft-tissue reconstruction in the head and neck, providing an unparalleled quantity of soft, supple tissue, with a concealed donor site.[1,6] However, the use of an ALT flap often requires secondary debulking procedures, and the donor site may still be undesirably conspicuous, especially for women.

A number of other perforator flaps have been used in head and neck reconstruction, including the deep inferior epigastric artery perforator flap, the gluteal artery perforator flap, the thoracodorsal artery perforator flap, and the peroneal artery perforator flap. All of these flaps have certain advantages in selected cases; however, all have issues with flap thickness or donor-site appearance.[5] This is why we wish to present data on the use of a new upcoming and promising versatile perforator flap, the SCIP flap.

SCIP flap

Anatomy

Similar to the conventional free groin flap, the SCIP flap is based on the superficial circumflex iliac artery (SCIA); the SCIA is 0.8 to 1.8 mm in diameter, arises from the femoral artery, and is located 2.5 cm inferior to the inguinal ligament.[4] The SCIA comprises a superficial and a deep branch. One of both branches may be absent, but there is always a dominant perforator through the sartorius muscle, usually the deep branch.[8] This dominant perforator has a mean diameter of 0.85 mm and has proven to be sufficient to nourish a large perforator groin flap.[4,9,10] Microdissection of this perforator vessel with a small segment of its feeding branch underneath the muscle yields a pedicle with an average length of 7 cm.[8]

The cutaneous vein (1.5 to 2 mm in diameter) in the adipose layer can be included as a venous drainage system for the flap, as the concomitant vein in SCIA is sometimes too small (<0.5 mm) to anastomose.[4,9]

Surgical techniques

As with other perforator flaps, Doppler ultrasound should be used to locate the perforators before harvesting. The design of this flap is somewhat more inferiorly located than the conventional free flap. Flap dissection always begins at the inferior margin, and the thickness of the flap can be adjusted to the context of the defect. Compared to the conventional groin flap, it is easier to resect a considerable amount of fatty tissue in one stage. For an experienced surgeon, the elevation time ranges from 30 to 90 minutes.[4] Direct closure of the donor-site defect is possible if the flap width is less than 10 cm.

Case report

We report the use of a SCIP flap for reconstruction after resection of an oral malignant tumor in two patients. A 43-year-old woman (patient 1, Figure 1) and a 55-year-old woman (patient 2) presented between 2010 and 2012, each with a squamous cell carcinoma of the right floor of the mouth and tongue (cT3N0 and cT2N0, respectively). Both patients had a history of tobacco use (10 pack-years and 35 pack-years respectively), and the second patient also abused alcohol (8 units a day). The rest of their medical histories was not relevant.

A tracheotomy was performed in both patients, followed by a neck dissection according to oncological guidelines.[11] The tumor was resected by a paramedian mandibulotomy approach, which combines optimal access and oncological control and which has functional results that are at least equal to, if not superior to, those obtained using pull-through procedures.[12] The SCIP flap (6×4 cm and 6×5 cm in patients 1 and 2, respectively) was then elevated and used to reconstruct the defect in a one-stage procedure. An end-to-end anastomosis was made to the facial artery and vein because of their matching caliber and close location. In both cases, direct closure of the concealed donor-site defect was possible.

Both flaps survived well. However, the second patient, who was at higher cardiovascular risk, needed a revision on day one for venous thrombosis. A new venous anastomosis, located more distally on the facial vein, was created to save the flap. In patient 1, surgery as monotherapy sufficed; patient 2, who had a complete resected pT2N0 lesion,

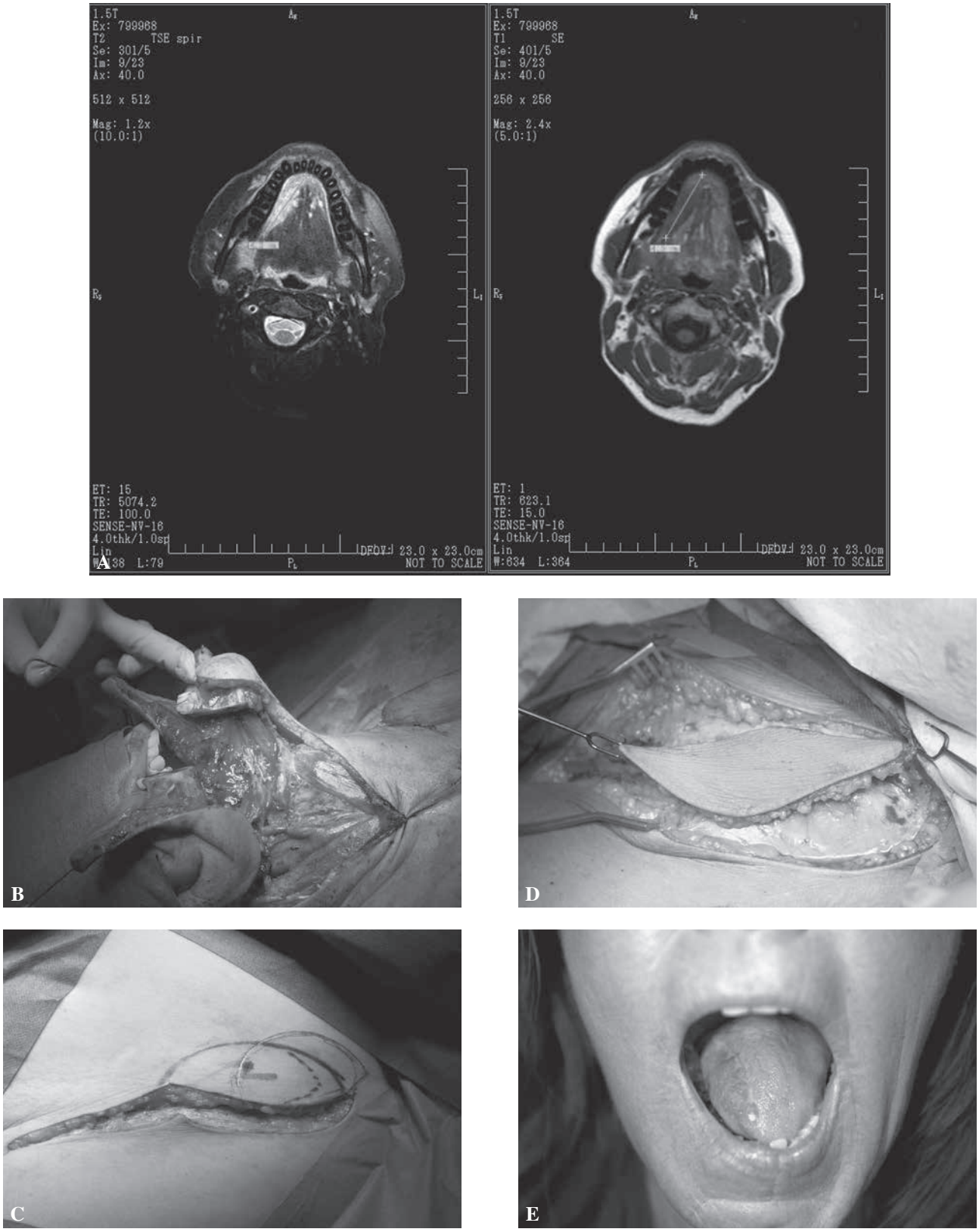

Figure 1

Patient 1, a 43-year-old woman with a squamous cell carcinoma of the right floor of the mouth and tongue. A, Pre-operative dimensions on MRI, showing a maximal diameter of 4.3 cm. B, The three-dimensional defect after complete resection of the tumor and lymph nodes. C, SCIP flap design in the concealed left groin region. D, The elevated flap. E, Two years after surgery.

Table 1

Reconstructive algorithm for intra-oral soft-tissue defects

Limited volume is needed - If donor site morbidity is not an issue: (suprafascial) RFFF - If donor site morbidity is an issue (e.g. young patient, woman): alternatives are: o ALT (more volume; visible scar) o SCIP (minimal volume; no visible scar; ideal for the floor of the mouth)
Substantial volume needed (e.g. hemi- or total glossectomy): - First choice: ALT (low donor site morbidity) - Second choice: rectus abdominis free flap (greater donor site morbidity)
In case of recurrence after radio(chemo)therapy or surgery: - ALT or RFFF (greater pedicle length and larger vessel caliber)

ALT: anterolateral thigh flap.
RFFF: radial forearm free flap (preferably suprafascially dissected).
SCIP: superficial circumflex iliac artery perforator flap.

underwent postoperative radiotherapy because of invasion of the extrinsic tongue muscles and perineural invasion on the pathology of the resected specimen. Currently, after 52 and 36 months of follow-up, respectively, there is good oncological control in both patients as well as good functional and aesthetic results.

Discussion

The use of a SCIP flap was first reported in 2004 by Koshima *et al*.[9] From then on, the flap was used for reconstruction of the limbs and penis.[4,9,13,14] However, reports of its application for use in the head and neck region are very limited.[4,10,15] Apart from one bilateral buccal reconstruction with a double-paddle SCIP flap by Hsu *et al*. in 2007,[4] only Koshima *et al*. have reported on the use of the SCIP flap in head and neck reconstruction in isolated cases in 2012 and 2013.[15,16,17,18] In 2014, the same authors presented twelve cases of SCIP flap transfer for reconstruction of various types of head and neck defects, reporting complete flap survival in all cases.[10] Most recently, Green *et al*.[19] reported the use of a SCIP flap following the resection of four intra-oral squamous cell carcinomas and one pharyngeal squamous cell carcinoma. Skin paddles of approximately 5×4 cm were designed, a pedicle of 6-7 cm was harvested, and arterial anastomosis was performed to a branch of the external carotid artery, with the facial artery being the favored option. They obtained excellent aesthetic and functional results at both the primary and donor sites. As noted above, we used our first two SCIP flaps in 2010 and 2012, and we obtained similar results.[19]

The advantages of the SCIP flap are as follows: 1) there is no need for a deeper and longer dissection of the SCIA system, as in the groin flap; 2) only the dominant perforator and a short length of the superficial or deep branch are required to nourish the flap; 3) thinning of the flap may be performed with primary defatting in one stage; 4) the flap elevation time for a microsurgeon is equal to that for conventional free flaps; 5) the patient is maintained in the supine position, which allows a two-team approach; 6) there is minimal donor-site morbidity as the donor site is located in a concealed area, so no muscle dissection is necessary and primary closure is readily possible; 7) a large cutaneous vein is available as a venous drainage system; and 8) the SCIP flap can be elevated in combination with bone, nerves, and lymph nodes.[16,17,18]

Nevertheless, the SCIP flap has some disadvantages. Supermicrosurgery is necessary to dissect and to anastomose the smaller and short pedicle vessels. And as with all perforator flaps, the location of the pedicle is variable. The most suitable free flap should be chosen after considering the aspects of the defect after tumor resection and the goals of reconstruction. Table 1 lists the flaps that we commonly use for intra-oral soft-tissue defects.

Conclusion

Here we report the use of a SCIP flap for reconstruction after resection of an oral malignant tumor in two patients. We obtained good functional and aesthetic results that were maintained during the 3- to 4-year follow-up. Our early experience, as well as the recently published similar results of

others,[10,19] indicate that this new perforator flap is a particularly versatile and useful option for the reconstruction of soft tissue defects in the head and neck. Compared to the site of the commonly used ALT flap, the donor site is even more concealed, and an ultra-thin skin flap can be obtained and used at the resection stage. Thus, the SCIP flap is an ideal thin, pliable, and reliable skin flap for reconstructing small intra-oral soft-tissue defects, particularly in women, without relevant comorbidity.

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