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Use of medial upper arm free flap in oral cavity reconstruction: a preliminary study

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Abstract. The medial upper arm has previously been proposed as a potential free flap donor site, but the clinical application of such flaps in head and neck reconstruction has not been popular. The preliminary results of the clinical application of medial upper arm free flaps in oral cavity reconstruction are reported here. Five patients with oral cancer underwent surgical resection and neck dissection, with simultaneous reconstruction using a medial upper arm free flap. Functional outcomes were investigated using the University of Washington Quality of Life Questionnaire. Sensory-motor functions of the upper arm donor site were recorded before and after surgery. Four flaps were successfully transferred. One flap was abandoned during surgery because of a lack of perforators, and a forearm flap was used instead. All patients survived without loco-regional recurrence or distant metastasis. Functional outcomes, especially swallowing and speech, were satisfactory. The donor site scar was well hidden, with no functional impairment. This initial experience shows that the medial upper arm free flap represents an alternative perforator flap for oral cavity microsurgical reconstruction. The well-hidden scar and better texture match compared with other flaps make it suitable for oral cavity reconstruction.

Key words: medial upper arm free flap; oral cavity reconstruction.

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Oral cancer is one of the most common malignancies worldwide. Surgical resection is still the first-line treatment, which leads to significant defects and functional impairment. Various soft tissue free flaps have been used in the restoration of tumour-related defects in oral cancer. The most commonly used free flaps include the anterolateral thigh flap (ALTF), lateral upper arm free flap (LUFF), and radial forearm free flap (RFFF). The functional results with these flaps are adequate, with no significant differences between flaps with regard to speech and swallowing. However, these flaps have certain associated problems. The disadvantages of the RFFF include a conspicuous unattractive scar in the forearm region, pain, numbness, and the sacrifice of a major artery of the limb. The ALTF and LUFF have recently come to be considered superior to the RFFF. However, ALTFs are bulky and not always suitable for restoring the function of the delicate oral region. Furthermore, all of these flaps are usually hair-bearing, especially in Caucasian males, which is problematic for oral cavity reconstruction.

The development of perforator flaps based on knowledge of the vascular anatomy of the skin represents a major advancement in the field of reconstructive surgery. The medial upper arm was pro-

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posed as a potential donor site for flap harvest in the 1970s: in 1975, Daniel et al. were the first to introduce the medial upper arm skin flap based on the superficial branch of the superior ulnar collateral artery (SUCA) with its associated medial brachial cutaneous nerve[1]. They dissected 16 cadavers and found that the SUCA – a collateral artery of the brachial artery or the deep brachial artery – was always present. However, the clinical trial of one free flap was abandoned at the time of the procedure because of the small vessel size (0.5–1.4 mm in diameter).

Further studies involving fresh cadaver dissections have been conducted, but controversy remains regarding the vascular anatomy of the upper medial arm. Moreover, the medial upper arm free flap has not gained as much popularity as the RFFF or LUFF for two main reasons: the vascular supply to the medial upper arm skin is not constant and the pedicle vessels for free flap transfer are too small or atrophied. However, the medial upper arm flap has several advantages: it includes elastic, thin, and hairless skin, and leaves a well-hidden donor site scar. This makes it appropriate for use in the reconstruction of some areas of the oral cavity that need a thin soft tissue free flap transfer.

Although this type of flap has been used in the past, it has not been used in the field of head and neck surgery for more than 10 years, and no recent studies have investigated its functional and surgical outcomes. The purpose of this study was to characterize the intraoperative anatomical landmarks and determine the clinical uses and pitfalls of the medial upper arm free flap. This flap was used in five patients to reconstruct soft tissue defects after radical resection and was found to be an acceptable perforator flap for reconstruction in cases of oral cancer.

Patients and methods

All data were collected from 2014 to 2016. The institutional review board approved this study. Five patients with oral cancer signed the informed consent agreement and underwent surgical resection and neck dissection in the Department of Oral and Maxillofacial Surgery, Guanghua School of Stomatology, Sun Yat-sen University. There were four cases of squamous cell carcinoma and one of adenoid cystic carcinoma (Table 1). The cancers were located in the oral cavity, including the buccal mucosa, floor of the mouth, lateral tongue, and soft palate (Fig. 1).

The oral defect was simultaneously restored using a medial upper arm free flap. Preoperative assessment included a clinical examination of the recipient and donor sites by an experienced surgeon. Surgical outcomes, including loco-regional recurrence and distant metastasis, were recorded. Functional outcomes of the oral defect were investigated using the University of Washington Quality of Life Questionnaire (UW-QOL). Sensory-motor functions of the upper arm donor site were recorded.

Surgical technique

As the arterial supply of the medial upper arm flap is not constant, the skin paddle was supplied by branches leading from the SUCA in most cases, and by direct cutaneous branches of the brachial artery in about 20% of cases. The key to raising the medial arm flap is the relationship between the vascular system and the ulnar nerve. As a result, the protocol for raising a medial upper arm flap is relatively complex.

Patient positioning

The patient is placed in a supine position with the upper arm brought into an abducted 90° position and the forearm maximally supinated to explore the donor area. In this position, flap raising can be performed simultaneously to primary tumour resection, and there is no need to use a tourniquet.

Flap design

The central axis of the skin paddle lies over the septum between the biceps brachii and triceps brachii muscles. The longitudinal axis of the flap is a line drawn from the medial epicondyle to the posterior axillary line. In the patients included in this study, the flap size was designed to be between 6 cm and 15 cm in length and less than 7 cm in width, thereby allowing primary closure of the donor area (Fig. 2). The distal margin of the flap is outlined 3 cm proximal to the medial epicondyle. Proximally, the flap may be extended to the axilla or distally extended to the medial epicondyle.

Flap raising

Perforators to the medial upper arm skin are rather difficult to find. Thus, careful dissection is necessary in all steps. The incision begins at the posterior margin of the flap, down to the triceps fascia, and the triceps muscle is exposed (Fig. 3). The dissection continues in an anterior direction, and the ulnar nerve is identified. During flap raising, great care must be taken to observe whether there are significant vessels directed towards the skin paddle that may contribute to cutaneous perfusion; all of these vessels must be preserved. The dissection is continued from the perforator to the parent artery, the SUCA. The junction of the SUCA with the brachial artery is identified. Then, the ulnar nerve is carefully dissected and isolated from the SUCA. The branches leading from the SUCA frequently pass beneath (or sometimes over) the ulnar nerve. In the case that the surgeon cannot find a significant vessel in the posterior incision, the anterior margin of the flap should be dissected. The anterior incision is made, the biceps muscle is identified, the flap is raised in a posterior direction, and the brachial artery and the median nerve are isolated.

In most cases, the SUCA is present as the dominant vessel for free flap transfer,

Table 1. Summary of patients with oral cancer.

Case	Age (years)/sex	Tumour site	Tumour size (cm)	pTNM	Pathology	Flap size (cm)	Follow-up (months)	Length and calibre of vessels (vein/artery)
1	73/M	FOM	1.5 × 1.0	T1N0M0	ACC	8 × 6	24	8 cm, 2.5 mm/2.0 mm
2	35/M	Right tongue	3 × 3	T2N0M0	Well- to moderately differentiated SCC	7 × 6	15	11 cm, 2.0 mm/2.0 mm
3	52/M	Left soft palate	NA	T4N0M0	SCC	13 × 6	14	7 cm, 2.0 mm/1.5 mm
4	43/M	Left tongue	3 × 2	T2N0M0	Well-differentiated SCC	8 × 6	14	12 cm, 1.5 mm/1.5 mm
5	62/F	Left buccal mucosa	1.5 × 2.0	T1N0M0	SCC	10 × 6	12	None

Abbreviation: ACC = adenoid cystic carcinoma, SCC = squamous cell carcinoma.

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