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A pilot study demonstrating the feasibility of supermicrosurgical end-to-side anastomosis onto large recipient vessels in head and neck reconstruction

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Summary In head and neck reconstruction using free flaps, microvascular anastomosis is commonly performed in an end-to-end fashion to relatively sizable arteries including the superficial temporal, facial, and superior thyroid arteries. With the recent developments of less invasive perforator flaps such as the superficial circumflex iliac artery perforator flap, anastomosis of smaller vessels of less than 0.8 mm diameter has become necessary; however, appropriate recipient arteries for end-to-end anastomosis are often absent. We have introduced supermicrosurgical end-to-side anastomosis to such arteries in 12 cases of head and neck reconstruction. Double-needle, short-thread microsutures were used to facilitate this procedure, and indocyanine green intraoperative angiography was used to confirm patency. All patients, except one with partial necrosis, survived. We believe that our method is a safe and reliable option for cases in which there is a discrepancy between the flap pedicle and recipient arteries.

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Introduction

With the advent of microsurgery, free flap transfer has become the first choice for head and neck reconstruction. Various types of free flaps including rectus abdominis (RA), anterolateral thigh (ALT), and radial forearm (RF) flaps have been used. The pedicle artery of these flaps is commonly anastomosed to relatively sizable arteries (2—4 mm) such as the superior thyroid, transverse cervical, lingual, facial, and superficial temporal arteries in an end-to-end (E-E) fashion. Recently, new perforator flaps such as superficial circumflex iliac artery perforator (SCIP), superficial inferior epigastric artery (SIEA), and ALT true perforator flaps have been introduced for head and neck reconstruction.[1—8] These confer various advantages such as reduced donor site morbidity and tailoring capability as well as short operation time. Since these flaps have smaller vessels than conventional flaps, recipient vessels that are appropriate for E-E anastomosis are often absent, especially in arteries (Figure 1). In situations where there is such a size discrepancy, we have introduced supermicrosurgical end-to-side (E-S) arterial anastomosis using the following technical refinements: (1) double-needle, short-thread microsutures and (2) indocyanine green (ICG) real-time, intraoperative angiography. Here, we present our method for head and neck reconstruction and review retrospectively the results to assess its feasibility and efficacy.

Patients and methods

Between 2010 and 2014, we performed surgeries for 192 cases of head and neck reconstruction using free flaps at the University of Tokyo Hospital. Among these cases, supermicrosurgical techniques were used in 28 cases (15%). In the supermicrosurgical case series, we performed E-S arterial anastomosis in 12 patients (12/28) and E-E anastomosis in 17 patients. All patients except one were solely dependent on the artery anastomosed in an E-S fashion (11/12). In one patient, the flap was perfused by two pedicle arteries (one E-E and one E-S). There were nine male and three female patients with an average age of 64 (range: 51—81) years. The primary disease was cancer of the external auditory canal in three patients, parotid cancer in two, facial skin cancer in two, orbital cancer in one, tongue cancer in one, oropharyngeal cancer in one, giant cholesteatoma in one, and mandibular tumor in one patient. Free flaps consisted of a SCIP flap in eight patients, SIEA flap in two, ICAP flap in one, and ALT true perforator flap in one patient. Follow-up periods ranged from 3 months to 5 years and 2 months (average 15 months). The details are shown in Table 1.

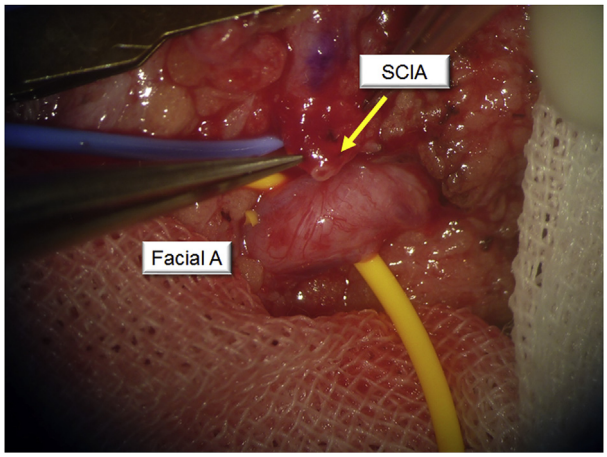

Figure 1 Large size discrepancy during small pedicle perforator flap transfer (Case 1, SCIP flap of 0.7 mm and facial artery of 4 mm). Because these flaps have smaller vessels than conventional flaps, recipient vessels appropriate for E-E anastomosis are often absent. In such situations, end-to-side (E-S) arterial anastomosis can overcome size discrepancy.

Operative techniques

First, recipient and flap vessels were prepared. Recipient vessels were dissected for at least 1.5 cm for E-S anastomosis. Excessive dissection may cause intimal damage of vasospasm. Regarding the flap vessels, the artery and the accompanying vein were separated to accommodate to the location of the recipient vessels. The recipient artery was clamped off proximally and distally. The flap vessels were cut perpendicularly to their axis.

Next, arteriotomy was performed. An elliptical region that is little larger than the flap vessel (about 1.2 times larger than the flap vessel) was marked on the side of the recipient artery. The adventitia of the marked area was removed using microscissors. Because the arterial wall of the recipient artery is usually thicker than that of the flap artery, this wide resection of the adventitia mitigates the discrepancy between two vessels. A smaller window, about the size of the flap vessel, was then made in the following fashion. First, a small transverse cut was made with the microscissors. Next, through this small incision, a blade of the microscissors was inserted into the lumen and an elliptical hole was created. The edge of the hole should be smoothed out to avoid development of thrombus.

Finally, supermicrovascular anastomosis was performed using the back-wall-first technique. Double-needle microsutures of 10—0 and 11—0 nylon (Keisei Medical Industry, Tokyo, JAPAN) were used for back wall suturing (Figure 2, movie 1).

Supplementary video related to this article can be found at http://dx.doi.org/10.1016/j.bjps.2016.09.018.

Arterial patency was confirmed by real-time, microscope-integrated ICG angiography (Pentero, Carl-Zeiss, Germany). One milliliter of ICG solution (5 mg/ml) was injected into an IV or CV line. The arterial phase, which appeared approximately at 1 min after the injection, and the venous phase, which appeared at 20 s after the arterial phase, were observed with an ICG near-infrared camera (Figure 3).

Results

All flaps except for one patient with partial necrosis, which was caused by venous thrombosis and salvage, completely