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Combined flaps based on the superficial temporal vascular system for reconstruction of facial defects

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Summary *Background:* Facial defects are multicomponent deficiencies rather than simple soft-tissue defects. Based on different branches of the superficial temporal vascular system, various tissue components can be obtained to reconstruct facial defects individually.
Methods: From January 2004 to December 2013, 31 patients underwent reconstruction of facial defects with composite flaps based on the superficial temporal vascular system.
Results: Twenty cases of nasal defects were repaired with skin and cartilage components, six cases of facial defects were treated with double island flaps of the skin and fascia, three patients underwent eyebrow and lower eyelid reconstruction with hairy and hairless flaps simultaneously, and two patients underwent soft-tissue repair with auricular combined flaps and cranial bone grafts. All flaps survived completely. Donor-site morbidity is minimal, closed primarily. Donor areas healed with acceptable cosmetic results. The final outcome was satisfactory.
Conclusion: Combined flaps based on the superficial temporal vascular system are a useful and versatile option in facial soft-tissue reconstruction.

Introduction

Facial bone and soft-tissue defects are always accompanied with facial trauma, tumor, malformation correction, or burns. Facial defects represent a unique challenge as its unique anatomic layers are associated with facial aesthetic units. The peripheral units include the forehead, cheek, and mentum, and the central units consist of the nose, eye, and lip. Furthermore, each unit has its own subunit as well as anatomical structure, and different unit's color, thickness, texture, and shape.

Most of these defects can be reconstructed with various types of local flaps. Optimal tissue should meet both the

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aesthetic and structural characteristics. Full-thickness facial defects may involve cutaneous, fascial, cartilaginous, or bony tissue simultaneously. Combined flaps should be considered for multicomponent deficiency, whereas local flaps need a combination of several flaps harvested at several donor sites.

Various combined flaps[1] can be designed based on the superficial temporal vascular system for the superficial temporal artery network can provide both various individual flaps and different tissue components such as calvarial bone,[2] helical cartilage,[3] fascia,[4] and skin with or without hair.[5] These tissues can be elevated as either a composite or a chimeric flap.

Here, we report our experience with the combined flaps based on the superficial temporal vascular system for the reconstruction of facial defects in 31 patients over a 10-year period.

Materials and methods

Anatomy

With the increasing use of the temporal flap, a number of anatomical studies of the superficial temporal vascular system[6,7] have been documented. Though the anatomical observation and statistics differ in detail, the analysis indicated that the temporal vascular system is relatively constant.

The superficial temporal artery is a terminal branch of the external carotid artery. Ascending between the tragus and the posterior root of the zygomatic arch, the superficial temporal artery nourishes the widespread territory including the frontal, temporal, parietal, and auricular regions. It gives off a middle temporal artery and a superior auricular branch in front of the auricle; then, it bifurcates into the frontal and parietal branches at the level superior to the zygomatic arch. The frontal branch further divides into the anterofrontal, centrofrontal, as well as posterofrontal branches (Figure 1). In anatomical layers, the superficial temporal artery lies in the superficial temporal fascia at the level of superficial musculoaponeurotic system (SMAS), and it runs into the deep temporal fascia at the level superior to the temporal line; then, it gives off multiple perforators to the periosteum and the outer layer of calvaria. The skin and superficial temporal fascia are mainly supplied by the superficial temporal artery, whereas the middle temporal artery is mainly distributed at the deep temporal fascia.

Patients

Thirty-one patients with various facial tissue defects received the combined flaps based on the superficial temporal vascular system as primary reconstruction.

Surgical method

Double island flaps

Double fasciocutaneous flaps are raised in the subfascial plane based on the anterofrontal and centrofrontal branches, respectively. Then, the double island flaps are transferred to the recipient sites through the subcutaneous tunnel. The donor site is closed primarily if the width of the flap is less than approximately 4 cm, and it is covered with skin grafts in the patients with a larger defect.

Auricular combined flaps

The elevated auricular combined flaps include the preauricular area and the helical rim with blood supplied by the branch of the superficial temporal artery in a retrograde fashion. The helical-rim flap including is designed according to the defect size and unit principle. The defect of donor site is repaired with an advancement flap of the remaining helical rim. The superficial temporal fascial flap can be designed with the helical-rim flap to fill the subcutaneous tissue deficiency. Then, the combined flaps are transferred to restore the defect.

Hairy and non-hairy chimeric flaps

Hair-bearing skin island flaps based on the posterofrontal branch or the parietal branch, depending on the defect size, can be designed around the posterofrontal branch or the parietal branch of the ipsilateral superficial temporal artery. The direction of the hair growth is considered

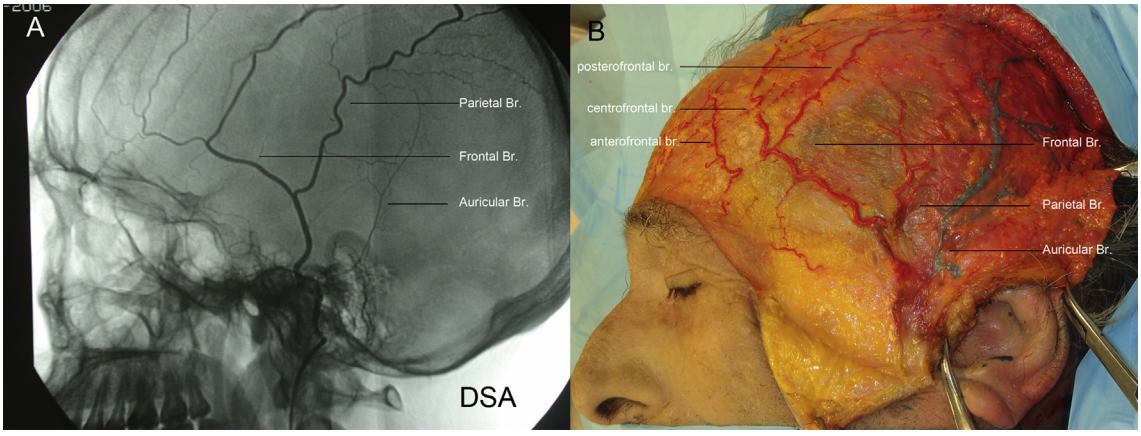

Figure 1 The anatomy of the branches of the superficial temporal artery in patients (A) and fresh cadavers (B).