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Reconstruction of the zygomatic cheek defects using a flap based on the pretragal perforator of the superficial temporal artery

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Summary *Background:* The aim of this study was to create a new flap based method for zygomatic cheek defect reconstruction using the pretragal perforator from the superficial temporal artery.
Methods: Ten fresh cadavers were dissected after vascular injection to study pretragal perforator distribution, length, and diameter. Twelve clinical cases of zygomatic cheek defects were reconstructed using pretragal perforator flaps. According to the location of the perforator that was preoperatively probed using an ultrasound Doppler blood flow detector and the zygomatic cheek defect condition, size, and distance from the distal border to the tragus and the flabby surrounding skin, we designed a spindle-shaped longitudinal flap in the preauricular region based on the pretragus. The flap was raised superficially to the superficial musculoaponeurotic system from the caudal border incised primarily to the cephalic border to create the perforator flap. The flap was sutured to the defect and the donor site was closed.
Results: Cadaver dissection showed a quite constant perforator given off by the superficial temporal artery or its auricular branches with an appearance rate of 85% anterior to the tragus. The average perforator length was 18.3 mm (range, 11.2–24.2 mm). The average perforator diameter was 0.65 mm (range, 0.4–1.15 mm). A total of 12 clinical cases were available for 6–12 month postoperative follow-up. Favorable survival, primary closure, and esthetic results were achieved without any complications.

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Conclusions: Zygomatic cheek defect reconstruction using the above-mentioned flap can achieve satisfactory esthetic and functional results and boasts a simple design, convenient procedure, reliable blood supply, and concealed donor site incision.

Despite being among the most frequently performed tasks by plastic surgeons, cosmetic and functionally pleasing reconstruction of zygomatic cheek defects caused by trauma, tumor, and infection can be challenging. The preferred methods of reconstruction in those defects that do not allow for primary closure and are not of excessive size involve local rather than free flaps, even if they are very thin. Not only are local flaps less time consuming to perform than free flaps but they also provide optimal color matching and are known for their excellent vascularity.

Most of the local flaps used to date for reconstructing zygomatic cheek defects were random flaps including the modified rhomboid flap, advanced flap, and rotation flap, which were limited in length—width ratio and freedom and resulted in obvious scarring.[1–3] Fueled by the concept of freestyle local perforator flaps and the development of facial perforator flaps in the past 10 years, it was hypothesized that an axis-pattern local flap based on a perforator (local perforator flaps) could gain a better result.[4] Furthermore, the skin of the preauricular region (parotideomasseteric region) adjacent to the zygomatic cheek region was flabby enough to be cut as a flap with primary closure and the scar concealed within the facial contour, especially in elderly men. Thus, the preauricular region, such as the nasolabial fold, is a potential ideal flap donor site.

To investigate the possible existence of a preauricular perforator, we performed 20 dissections of the blood supply in the preauricular skin of fresh cadavers and found a quite constant branch given off by the superficial temporal arteries (STAs) crossing the superficial musculoaponeurotic system (SMAS) anterior to the tragus to supply the skin infra-anterior to the auricle (parotideomasseteric region). Based on the pretragal perforator branch of the STA, we designed a series of local perforator flaps and successfully reconstructed the cheek defects of 12 patients.

Patients and methods

Cadaver study

A total of 10 adult cadavers (seven men, three women) that had been fixed in a 10% formalin solution with 20 STAs were dissected at the Department of Anatomy, Second Military Medical University. The cadavers were 29—65 years of age. After a red latex solution was injected into the external carotid artery, the STA and its branches were dissected under 2.5 loupe magnification.

The pretragal perforator artery was identified from an exploratory incision on the preauricular crease. Dye-colored vessels reaching the skin were followed back to the origin through the SMAS into the STA. Only a major vessel descending from the skin, which followed a direct or indirect course to the STA, was identified as a pretragal perforator (Figure 1). Once this perforator was found, it was dissected meticulously from its origin at the STA trunk or the auricular branch to the skin. The general course of the auricular branches given off by the STA was identified as previously classified.[5,6] The total length of the perforator as dissected was measured in millimeters. The course of the perforator and its subcutaneous branches supplying the overlying skin were also indentified. The diameters of the pretragal perforators at their origin were measured under a dissection microscope (Stemi SV11; Zeiss, Jena, Germany) using a grid (2 mm in 200 parts; E. Leitz GmbH, Wetzlar, Germany).

Clinical cases

Between August 2010 and February 2014, 12 patients (seven men, five women) aged 46—74 years (mean, 58.7 years) underwent surgery for zygomatic cheek defects. Tumor excision was the most common cause of defect (10 cases), followed by trauma (two cases). Pathological diagnoses of tumor lesions included basal cell carcinoma ($n = 7$) and squamous cell carcinoma (SCC) ($n = 3$). Flap sizes ranged from 4 × 2 to 8 × 3.5 cm. The average follow-up time was 10 months (range, 6—12 months).

Surgical technique

After the defect was created, reconstruction was planned by adhering as much as possible to the esthetic unit principle for cheek reconstruction. The defect was measured and a corresponding flap was designed on the skin anteroinferior to the ear pedicle on the pretragal perforator. To create a greater arc of rotation, the pedicle is always set on the flap edge. The exact location of the perforator was determined by preoperative Doppler ultrasonography assessment. The longitudinal flap was bound by the preauricular crease laterally with an available length over the mandibular angle to the neck to allow concealing of the donor site scar by the facial contour.

The flap was elevated superficially to the SMAS from the caudal border incised primarily to the cephalic border. Flap elevation was maintained until sufficient rotation was achieved, while meticulous dissection was required around the preauricular perforators along the cephalic portion of the flap. The dissection could be performed under loupe magnification when necessary. After confirmation of the perforator incorporation in the pedicle and tension-free