The Reliability and Versatility of Facial Artery Perforator-Based Nasolabial Flaps in the Reconstruction of Lip Defects

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Abstract

Background: The lips are the active focal point of the lower third of the face, making lip reconstruction a particularly difficult task for a plastic surgeon. The goals of lip reconstruction are both functional and aesthetic, and the surgical techniques frequently overlap.

Objective: To assess the functional and aesthetic results of facial artery perforator-based nasolabial flaps in the reconstruction of lip defects, regarding flap survival and complications, donor site morbidity, and the aesthetic outcome of the flap and donor site.

Patients and Methods: Twenty patients participated in the current study, which was conducted from January 2020 to January 2022 and included a six-month follow-up. Eight cases had post-tumor resection lip defects. Twelve flaps had post-traumatic defects; the defect size ranged from ½ to 2/3 of the lip size.

Results: Twelve flaps survived completely; venous congestion was treated conservatively in six flaps; two flaps required debridement due to distal flap necrosis, reconstructed by local flap advancement. In fifteen cases, the donor site scar was extremely good.

Conclusion: Nasolabial flaps based on the facial artery perforator are easy to harvest, simple, and reliable. They offer a satisfactory functional outcome with preservation of touch and temperature sensibility, particularly when the defect is accompanied by substantial mucosal and cutaneous abnormalities.

Key Words: Facial Artery Perforator Nasolabial Flaps (FAP) – Nasolabial Flaps – Reconstruction of Lip Defects.

Ethical Committee: This research was granted approval by Medical Research Ethics Committee of Sohag Faculty of Medicine [Soh-Med-21-07-07]. The treatment plan was thoroughly

discussed with the patients. An informed written consent was obtained from all patients.

Disclosure: No disclosure.

Introduction

The lips are the active focal point of the lower third of the face, making lip reconstruction a particularly difficult task for a plastic surgeon. No other tissue can perform the functions it does in terms of aesthetic balance, expression, and communication [1]. Lip reconstruction pursues both practical and aesthetic goals, and the surgical techniques often overlap. The aesthetic goals are to maintain the aesthetic harmony of the vermiliocutaneous junction while ensuring an adequate restoration of skin. The functional objectives are to preserve the mucosal lining inside the mouth and protect the oral opening's surface area. A functional recovery necessitates the orbicularis muscle sphincter's function [1,2]. Restoring facial and intraoral abnormalities caused by trauma, neoplasia, or infection is a difficult task. Due to their perfect color and texture, their little impact on the donor site, and the low occurrence of complications, local flaps, such as nasolabial flaps, are often the most suitable choice for repairing small to medium-sized regions [3].

Patients with coexisting conditions can undergo this procedure while under local anesthesia, and this flap has the benefit of an unnoticeable scar [3]. Several flaps are available for repairing defects in the mouth and face. Nasolabial flaps are well-suited for treating minor to moderate-sized abnormalities that would be too difficult to address with bigger flaps, such as the pectoralis major flap. Nasolabial flaps, although often used for intraoral abnormalities, have restricted mobility and may need a twostage treatment approach. The first genuine perforator flap in face restoration is the facial artery perforator-based flap. The facial artery supplies many cutaneous perforators that may be used to create skin flaps, enabling more mobility and the

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ability to repair modest to moderate abnormalities in the mouth and face in a single operation [4,5]. The average number of perforators along the facial artery is 4, about 2–8 on each side, and their average diameter is 0.94mm (0.53-1.36mm), originate from the facial artery within 20 and 60 millimeters (mm) from its beginning [6].

The nasolabial flap (NLF) is a historical technique used in the early stages of facial soft tissue defect reconstruction. Sushruta, an ancient Indian surgeon, documented a soft tissue flap that has a striking resemblance to the contemporary nasolabial flap. Facial or oral cavity skin reconstructions may be accomplished by using the skin reservoir located next to the nasolabial fold [7]. Most NLFs consist of random patterns. Certain NLFs may be engineered with an axial blood supply pattern. The inferior-based nasolabial flap receives blood supply from the facial artery. The retro angular flap and the orbito-nasolabial flap are two types of superiorly based reverse flow nasolabial flaps that include the angular artery [8]. The NLF, based on a perforating branch of the facial artery, is a versatile flap that benefits from an axial blood supply and is thinner because the muscle of expression is not included in the flap [9]. NLF has been used in facial skin restoration procedures, including the ipsilateral infraorbital, cheek, and lower eyelid (advancement flap), upper lip (rotational flap), philtrum (tunneled flap), commissure, lower lip, and chin (transpositional flap). When the ipsilateral NLF is not accessible for reconstruction, the contralateral NLF might be considered for midline abnormalities. This flap is mostly used for face reconstruction of several regions of the nose, including the columella, tip, ala, and lateral aspect. It is also used for skin covering and as a cushion for the vestibule and nasal septum. Furthermore, it may also serve as a rotation flap when combined with the forehead flap [10]. The research conducted on facial angiosomes demonstrates that the facial artery perforator flap is successful in supplying blood to the skin from the submental region to the medial two-thirds of the face. The perioral and perinasal regions have a significantly elevated density of perforators, as seen in cadaver studies. There are five perforators in each facial artery, and each of them has an average diameter of 0.96mm. The average size of all applied skin regions was 8.05cm², and the ink solution was selectively injected into the perforators. Researchers have identified three distinct etiologies for facial artery perforator flaps: The first level was defined as the area between the nasal alae and the glabella. The second level was recognized as the region between the angle of the mouth and a horizontal line running through the lowest points of the zygomatic processes of the maxilla. The third level is defined as the area situated underneath a horizontal line crossing across the jawline and the point of origin of the submental artery [11].

The purpose of this study was to assess the functional and aesthetic results of facial artery perforator-based nasolabial flap in the reconstruction of post traumatic or post tumor resection lip defects.

Patients and Methods

Our prospective clinical trial study included 20 patients with lip defects greater than ½ of lip resulting from trauma or tumor excision, which was conducted from January 2020 to January 2022 in the plastic surgery department of Sohag University Hospital. The patients were followed-up for six months after the surgery.

Patient evaluation:

All patients were evaluated through history-taking, clinical examination, and doppler. Preoperative, intraoperative, and postoperative photographic documentation was done.

Surgical technique:

Using a portable Doppler probe, a facial artery perforator was identified and marked along the nasolabial fold. In order to complete a sufficient arc of rotation without tension, a perforator close to the defect was chosen. The marking of the flap was done after an estimation of the post-operative defect size.

The purpose of the flap was to conceal the donor site situated in the nasolabial fold and provide protection for the deformity. One side of the flap had been incised. The flap was undermined until the origin of the perforator was found. After identifying the perforators, a complete incision was made around the circumference, and the flap was reconstructed. Once the pedicle was dissected, the distal perforators were intentionally sacrificed in order to ease the mobility of the flap until it could be transposed without tension, thereby filling the defect. A layer of subcutaneous fat was deliberately retained around the perforator to serve as a protective barrier against shear forces.



Fig. (1): Dissection of the pedicle until tension-free transposition.

Egypt, J. Plast. Reconstr. Surg., April 2025

Follow-up: Patients were followed-up weekly for the first month after discharge, then monthly when no complications required closer follow-up. Photos were taken at every visit.

Ethical approval: This research was granted approval by Medical Research Ethics Committee of Sohag Faculty of Medicine. The treatment plan was thoroughly discussed with the patients. An informed written consent was obtained from all patients.

Statistical analysis: Clinical investigation, historical data, and outcome measures were coded, entered, and analyzed. Mean, standard deviation (\pm SD), range, and percentage are used for parametric numerical data.

Results

Venous congestion was treated conservatively in six cases. Two cases required debridement due to distal flap necrosis, and one of them required a mucosal advancement flap.

Table (1):	Distribution	of	studied	cases	based	on	personal	in-
	formation.							

	Cases (No=20)		
Age:			
Range	12-85		
Mean \pm SD	49.65±22.13		
Gender:			
Female	6 30%		
Male	14 70%		

Table (2): Distribution of studied cases based on etiology.

	Cases (No=20)		
Etiology:			
Post traumatic	12	60%	
Post tumor resection	8	40%	

Table (3): Distribution of studied cases based on criteria of the defect.

	Cases (No=20)		
Site:			
Lower lip	8	40%	
Upper lip	12	60%	
Scar assessment:			
Fair	5	25%	
Good	15	75%	



Fig. (2): Distribution of studied cases based on defect size.

Table (4): Distribution of studied cases based on time of operation and hospital stay.

Hospital stays				
Range	2-10			
Mean ± SD	5.35±2.54			



Fig. (3): Distribution of studied cases based on complications.



Fig. (4): (A) Shows pre-operative, (B) Shows intraoperative after tumor resection and (C&D) Shows the late post-operative.

Case (2): 70 years old female patient with ulcerative lesion on lower lip.



Fig. (5): (A) Shows pre-operative, (B) Shows intraoperative after tumor excision, (C) Shows intraoperative (Flap harvesting), (D) Shows post-operative.



Case (3): 57 years old female patients with ulcerative lesion on lower lip.

Fig. (6): (A) Shows pre-operative, (B) Shows intraoperative, (C) Shows early post-operative, (D) Shows late post-operative.

Discussion

A total of 17 instances of upper lip reconstruction followed tumor excision by utilizing the FAP flap technique. The outcomes were considered good from both the patients' and surgical perspectives, with little deformity seen in the treated area and effective recovery in all donor sites [12].

Venous congestion was more frequent in older patients and this can be attributed to atherosclerosis which is more obvious as patient get older. A broader scope of FAP flap utilization was explored, primarily used for reconstructive reasons in the lower two-thirds of the face after tumor excision, infections, or injuries. The outcomes were highly favorable, with successful reconstructions of the upper and lower lip, cheek, nasal area, and intraoral regions, without any instances of partial or complete flap failure [13].

It was observed that the FAP flap could rotate around the axis by more than 90°, thereby filling and covering the whole defect, while also allowing for closure of the donor site. No upper lip deformity was seen, the skin color was appropriate, and excellent facial symmetry was achieved. There were no complications, however the trapdoor phenomenon occurred. The main cause of its formation is likely to be the obstruction of lymphatic and venous flow, but scar hypertrophy and excessive subcutaneous adipose tissue may also contribute to the situation [14].

In the current study we found that the mean age group of study was 49.6 and this denotes that majority of patients were adults and this can be explained by higher incidence of trauma/tumor (major causes of lip defects) among adult patients compared with children and teenagers. In general, trauma is more frequent cause for lip defects compared with tumor resection and more common in young age groups. In our study trauma was the aetiology for lip defects in 60% of study patients with assault was the commonest pattern.

In our study flap dissection and elevation was more tedious and took longer duration in traumatic defects compared with tumor resection and this can be explained by edema and fibrosis encountered in trauma patients.

These perforators may be used to create local skin flaps that can be separated from the surrounding tissue, giving surgeons more flexibility in terms of flap design, mobility, and reach. This allows the flaps to be used for one stage reconstruction of small-to-moderate intraoral and facial defects while still offering all the benefits of nasolabial flaps. Out of 40 cases, the researchers discovered that two individuals had partial flap necrosis, three individuals had partial wound dehiscence, and five individuals developed hypertrophic scars [15].

In our present study we found that according to site, there were 8 (40%) with lower lip and 12 (60%) with upper lip defects. According to defect size there were 4 (20%) with 1/2 of lip, 11 (55%) with more than 1/2 of lip and 5 (25%) with more than 2/3 of lip. Defect site and size are directly related to incidence of complications.

Based on the results, 6 out of 42 patients had venous congestion. Subcutaneous administration of heparin injections effectively treated this condition, leading to the resolving of venous congestion in all patients, without the need for further surgical intervention [16]. It was reported that a series with two minor complications, with two flaps showing venous stasis without flap loss [17]. In this study 6 out of 20 patients (30%) encountered flap congestion which was more frequent with lower lip reconstruction as venous kinking and outflow obstruction were more significant with lower lip reconstruction compared with upper lip. Venous congestion was more frequent in older patients and this can be attributed to atherosclerosis which is more obvious as patient get older. There were no complications seen in the early postoperative period, such as hematoma, inflammation, dehiscence, facial nerve paralysis, or partial or entire flap necrosis. Functional and aesthetic sufficiency as twelve patients had positive outcomes in the restored areas with little complications at the donor areas [18].

There was no bleeding or infection and all 19 patients had an acceptable single-stage restoration using flaps based on perforators. There were two minor issues early in the series. Venous stasis resulted in partial epidermolysis and spontaneous re-epithelialization in the flap in two patients. Particularly in round or oval-shaped flaps, there may be some early edema and sporadic trap door deformity. But this settles after three to six months. Nobody required further surgical intervention [19].

In our study trapdoor deformity was more frequent with lower lip reconstruction because of greater arc of rotation. It was reported that using facial artery perforator NLF to reconstruct the lips of eight patients following tumor removal.

Each patient was pleased with the outcome of surgery. Two cases of early congestion in a propeller pattern completely resolved conservatively. One case pursuit a smaller donor site scar, that replaced with a skin graft [20].

In the current study two cases (10%) experienced distal flap necrosis, which required debridement; and one case required a mucosal advancement flap, we found that the mean hospital stay of studied case was 5.35 (±2.54 SD) with range (2-10) days. As regard Donor site morbidity, one patient encountered minor dehiscence of donor site which was treated conservatively with local wound care.

Conclusion:

To summarize, the nasolabial flaps based on the facial artery perforator are simple to harvest, uncomplicated, and reliable. Particularly in cases where the defect is accompanied by substantial mucosal and cutaneous abnormalities, it has a favorable functional result. The preservation of touch and thermal sensitivity contributes to an improved functional outcome When applied to carefully selected patients, nasolabial flaps based on the facial artery perforator can be an effective alternative flap for microvascular reconstruction of the lip, allowing for preservation of sensation and improved functional outcomes. Wider utilization of this flap will only increase the reliability and superiority of this flap in lip reconstruction.

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