

Nasal reconstruction with the two stages vs three stages forehead flap. A three centres experience over ten years

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Abstract. – INTRODUCTION: In nasal reconstruction all anatomic layers as cover, lining, and support, have to be replaced to restore proper aesthetics.

Forehead skin has been acknowledged as the best donor site to resurface the nose. Traditionally forehead flap reconstruction is performed in two stages, but Millard described an intermediate third stage between flap transfer and pedicle division. This study compared the two methods.

MATERIALS AND METHODS: The study enrolled 31 patients undergoing total or subtotal nose reconstruction between January 2001 and January 2012. 20 patients underwent to the two-step technique (2S Group), and 11 the three-step technique (3S Group). Thickness of the flap was measured in three different areas. A plastic surgeon not involved in the study completed an evaluation questionnaire to assess aesthetic satisfaction (VAS = 1-10).

RESULTS: The total number of procedures performed (including revisions) ranged from 3 to 6. The average number of procedures performed in group 2S patients was 4 (range: 3-6) in the group 3S was 3.46 (range: 3-5). VAS mean values were studied with t Student test and were found to be significant.

DISCUSSION: The timing of thinning of the flap and detachment of the pedicle varies among Authors. There are generally two trends: defatting of the flap before the pedicle transection, performed usually 3 weeks from flap harvesting and defatting a few months after disconnection of the pedicle. We think this technique is suited for defects including underlying structures and particularly for all those defects located in the distal part of the nose (tip and nostrils).

Key Words:

Nasal reconstruction, Forehead flap, Vascular delay.

Introduction

Nasal reconstruction can be considered as the historic centrepiece of plastic surgery. The

unique anatomy combined with its aesthetic and functional importance makes nose reconstruction challenging. All anatomic layers (cover, lining, and support) have to be replaced to restore good aesthetics.

Because of the ideal quality of its colour and texture, forehead skin has been acknowledged as the best donor site to resurface the nose¹⁻². Traditionally forehead flap reconstruction is performed in two stages. However, because of the forehead conformation (skin, subcutaneous fat, frontalis muscle and a thin layer of areolar tissue overlying the periosteum and bone), it is problematic to restore a good shape in a single step procedure so, usually, secondary surgical revisions during the following 6-12 months are required³⁻⁶.

To overcome these problems, in 1974 Millard described an intermediate stage between flap transfer and pedicle division to carve alae and tip, believing that flap thinning would be safer preserving the pedicle⁴.

Burget and Menick⁵ in 1992 recommended that no distal thinning would be initially performed in major reconstructions. All finishes could be performed during the second stage, thus creating a thin cover flap and a shaped underlying bed. According to this approach the pedicle would be sectioned during a third stage.

Basically, there is no agreement about what the best reconstructive method would be⁸⁻¹¹. This study compared the two techniques with regard to the number of procedures performed by patients to achieve optimal aesthetical and functional results. Thickness of the skin flap was measured during the second stage of both the techniques. Finally, aesthetic satisfaction of patients was investigated with a questionnaire administered after one and six month.



Figure 1. Two-step nasal reconstruction with the forehead flap. Bulkiness is still present. **A**, Preoperative, frontal view. **B**, Postoperative, frontal view. **C**, Preoperative, side view. **D**, Postoperative, side view.

Materials and Methods

The study enrolled 31 patients undergoing total and subtotal nasal reconstruction with a forehead flap in three different Plastic Surgery units between January 2001 to January 2011. Patients inclusion criteria were defects larger than 1.5 cm, ASA < 3. Exclusion criteria were ASA > 3, previous surgery on the forehead area and age < 18 years old. Epidemiological data were collected (age, sex, age of lesion onset, histology and localization).

Patients were divided in Group 2S (20 patients underwent the two-stage technique) and 3S (11 patients underwent the 3-stage technique). During the second stage of both techniques the thickness of the flap was measured in three areas: the tip, the dorsum and the sidewall. Patients complete an evaluation questionnaire to assess aesthetic satisfaction (Visual Analogical Scale, VAS = 1-10) one month postoperatively and 6 month postoperatively. The same questionnaire was administered to a plastic surgeon not involved in the study. The average follow-up

was 6.1 years (minimum follow-up 1 year). The collected data were subjected to statistical analysis. VAS mean values were compared using the *t* Student test. Other statistical indicators evaluated were mean, *p* value, 95% confidence interval, degree of freedom, standard error of difference.

Surgical technique

All patients underwent preoperatively to blood tests, chest Roentgenograms and cardiac assessment. Evaluation of the vessels' quality was investigated preoperatively with an hand-held Doppler. General anaesthesia or local analgesia with intravenous sedation was performed. All patients underwent Mohs' histographic excision before reconstruction.

The first stage is the same in both techniques and consists in raising a forehead full-thickness flap without thinning it (except for columellar area). At the second stage of traditional technique (2S), after three weeks, the pedicle of the flap is divided without further or with minimal

thinning. The two-stage technique, although quicker, almost inevitably required reoperation in the following months and years to achieve a good cosmetic result (Figure 1 A-D).

The three-stage technique interposes a second time, three weeks after first surgery. Skin and subcutaneous fat are elevated and thinned, except for columellar area. In addition, underlying muscle and cartilage are shaped to create a good rigid matrix on which the thin skin can overlie. The third stage involves section of the pedicle after three weeks from the second stage (6 weeks from first surgery) (Figure 2 A-E).

Results

Epidemiological data were analyzed showing that 18 out of the 31 patients were females and 13

males and average age was of 68 years-old, ranging from 37 to 87 years. The average age of onset of tumors was 65 years (34 to 86 years-old). The most common histology was basal cell carcinomas affecting 23 patients (74.2%), squamous cell carcinomas affecting 5 patients (16.1%) and melanomas affecting 3 patients (9.7%). The most common localization was dorsum in 19 patients (61.3%), sidewall in 12 patients (38.7%). The total number of procedure performed ranges from 3 to 6. Fourteen patients underwent three procedures, 11 patients 4 procedures, 4 patients 5 procedures and 2 patients 6 procedures. The average number of procedures performed in group 2S patients was 4 (range: 3-6) in the group 3S was 3.46 (range: 3-5) (Figure 3).

The average skin thickness measured in group 2s was of 3.26 mm on the tip, of 3.63 mm on the dorsum and of 3.6 mm on the sidewall.

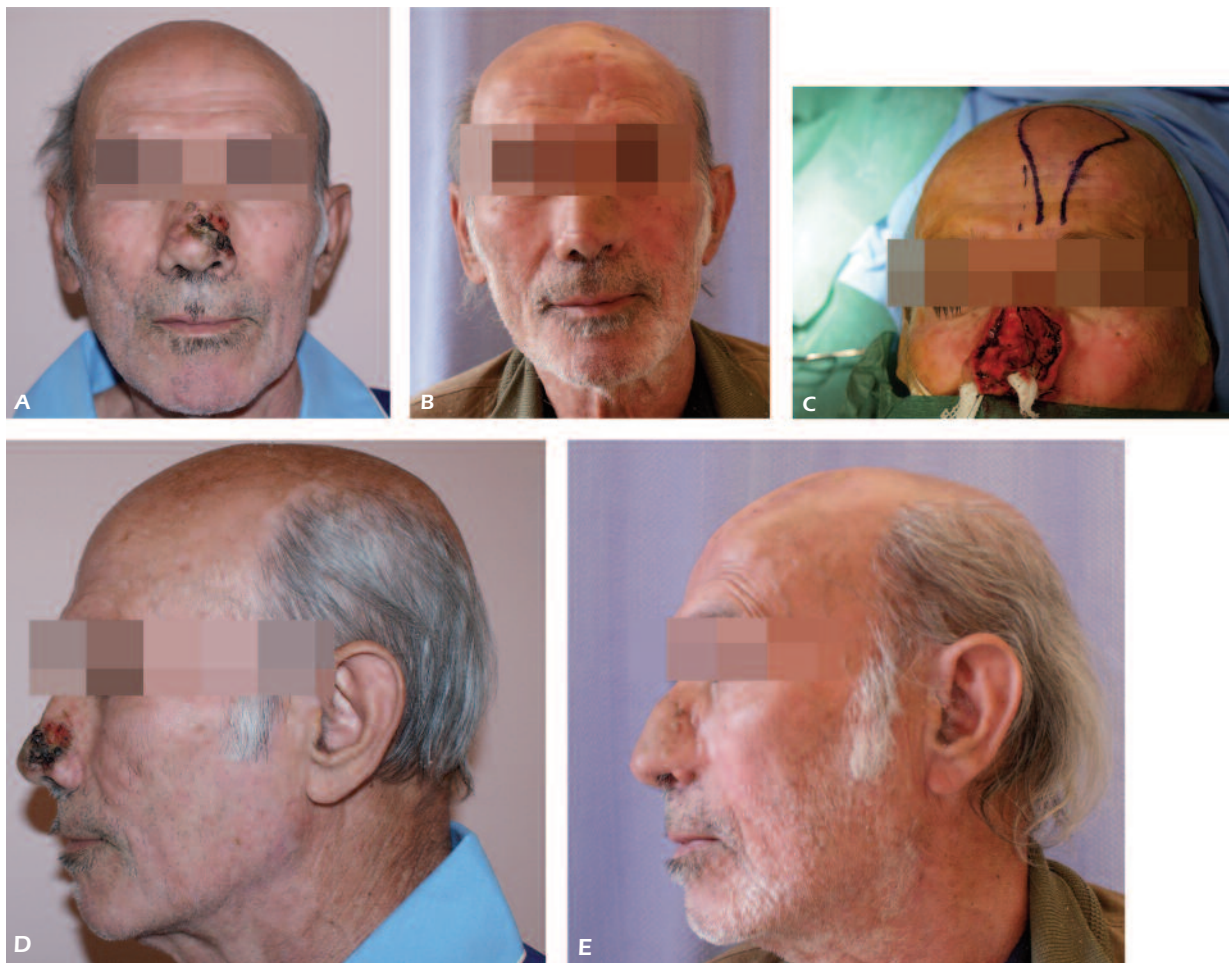


Figure 2. Three-step nasal reconstruction with the forehead flap. Reconstruction is tender, supple, and contour is perfect. **A**, Preoperative, frontal view. **B**, Postoperative, frontal view. **C**, Intraoperative view. **D**, Preoperative, side view. **E**, Postoperative, side view.

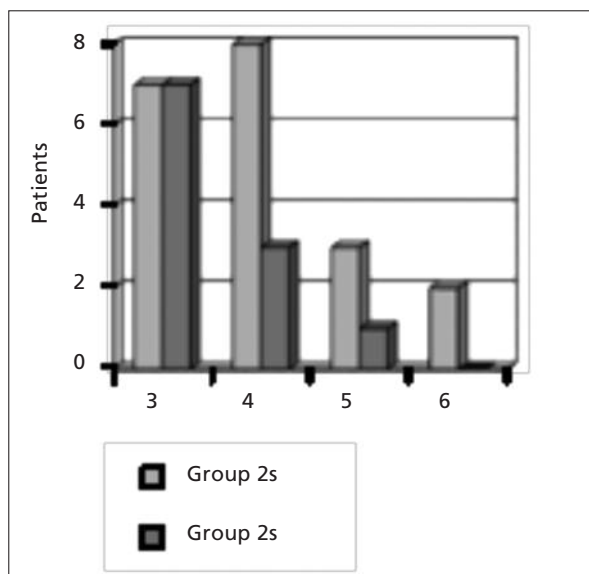


Figure 3. Skin thickness on dorsum, sidewall and tip.

The average skin thickness evaluated in group 3S was of 1.62 mm on the tip, of 1.84 mm on the dorsum, 1.86 mm on the sidewall (Table I).

The average values of aesthetic satisfaction in patients (VAS) were 6.4 in Group 3S one month post-operatively and 8.0 six month postoperatively. The values of the group 2S were 5.6 one month post-operatively and 7.0 six month post-operatively. Values reported by the surgeon were an average of 7.0 after one month and 8.0 after six months in group 3S. In group 2s one month postoperatively the mean value was 5.4 and 6.3 six months postoperatively (Table II). VAS mean values were studied with *t*-Student test and were found to be significant (Tables III, IV, V, VI).

Two patients of 2S group developed partial necrosis of the flap. One patient of 3S group suffered a small dehiscence and no functional problems were reported. No complications such as dehiscence or necrosis dependent on the donor site were described.

Discussion

Most of the textbooks and many articles deal with various techniques for nasal reconstruction¹²⁻¹⁴.

Large deep defects require a regional flap such as a nasolabial¹⁵ or, most often, a forehead flap¹⁵⁻¹⁸.

If the defect is larger than 1.5 cm, especially if within 0.5 to 1 cm of the nostril margin, there is not enough residual skin to redistribute over the remaining nose and a forehead flap is mandatory.

In addition, since the color and the texture of the nasal skin are unique, the forehead flap is considered the best-matched flap. Furthermore paramedian forehead flap has obvious advantages and it is commonly preferred to the median forehead flap for nasal reconstruction^{6,7}.

Traditionally, the forehead is transferred in two stages and later secondary revised at intervals of 6 to 12 months^{5,8}. The forehead, containing skin, subcutaneous fat, and frontalis muscle, is thicker than nasal skin and a distal thinning before recipient inset is needed. Three weeks later, once vascularized at the inset, the pedicle is divided and the proximal flap debulked. The two-stage flap is especially useful in smaller and superficial defects.

Multiple late secondary revisions are often required once soft tissues matured and became soft. So 6 to 12 months after first surgery, the flap is partially re-elevated through the scarred, subdermal plane. However, the skin results stiff, contracted, and noncompliant because of subcutaneous fibrosis, and it is easy to manage it.

Table I. Skin thickness on dorsum, sidewall and tip

Patient	Group	Tip	Dorsum	Sidewall
1	2s	3.3	4.1	4.0
2	3s	1.5	2.0	2.0
3	2s	2.8	3.8	3.5
4	2s	3.0	3.5	3.9
5	2s	3.1	3.6	4.0
6	3s	1.6	1.8	2.1
7	2s	3.1	3.7	3.6
8	3s	1.6	1.8	1.8
9	3s	1.5	2.0	2.0
10	2s	3.1	3.7	3.4
11	3s	1.6	1.8	2.0
12	2s	3.0	3.4	3.1
13	2s	3.2	3.5	3.9
14	3s	1.5	1.7	1.8
15	2s	3.2	3.4	3.4
16	2s	3.7	4	3.8
17	2s	3.7	3.9	3.7
18	3s	1.9	2.0	1.8
19	2s	3.4	3.7	3.4
20	2s	3.4	3.4	3.8
21	3s	1.7	1.8	1.8
22	2s	3.4	3.6	3.6
23	2s	3.3	3.4	3.7
24	3s	1.5	1.7	1.3
25	2s	3.5	3.8	3.5
26	2s	3.6	3.8	3.6
27	3s	1.8	1.9	2.0
28	2s	3.1	3.4	3.5
29	2s	3.2	3.4	3.4
30	2s	3.1	3.5	3.5
31	3s	1.7	1.8	1.8

Table II. Patient (P) and surgeon (S) aesthetic evaluation (VAS: 1 no satisfaction, 10: total satisfaction)

Patient	Group	VAS (P) 1 month	VAS (P) 6 month	VAS (S) 1 month	VAS (S) 6 month
1	2s	5	7	5	6
2	3s	7	9	8	9
3	2s	6	7	5	6
4	2s	7	8	6	7
5	2s	6	8	6	7
6	3s	7	8	7	8
7	2s	5	7	4	6
8	3s	7	8	8	8
9	3s	6	7	7	9
10	2s	5	7	4	6
11	3s	6	8	7	8
12	2s	5	6	6	6
13	2s	6	7	5	6
14	3s	6	8	5	7
15	2s	6	7	6	6
16	2s	4	5	4	5
17	2s	6	8	6	7
18	3s	6	8	7	8
19	2s	6	8	6	7
20	2s	5	6	5	7
21	3s	8	9	8	9
22	2s	5	6	5	6
23	2s	6	7	6	6
24	3s	6	8	7	7
25	2s	6	6	6	6
26	2s	7	9	7	8
27	3s	5	7	6	7
28	2s	6	6	5	6
29	2s	5	8	5	6
30	2s	6	7	6	6
31	3s	6	8	7	8

To avoid piecemeal thinning and allow soft tissue excisional sculpting a paramedian forehead flap may be transferred as a full-thickness flap without initial thinning using a three stages technique^{19,20}. This technique is especially useful when a large defect requires a large flap, complex contour restoration or lining.

The three-stage forehead flap technique with an intermediate step allows the surgeon to trans-

Table III. *t*-Student test of aesthetical evaluation (VAS) after one month according to patients.

N	M	<i>p</i>	95% ci	df	SED	<i>t</i>
11 (3s)	5.65 (3s)	<0.019	-1.30/-0.12	29	0.28	2.47
20 (2s)	6.4 (2s)					

Legend: N = number of patients, M = mean, *p* = *p* value, 95% CI = 95% confidence interval, df = degree of freedom, SED = standard error of difference, *t* = *t* value.

Table IV. *t*-Student test of aesthetical evaluation (VAS) after one month according to patients.

N	M	<i>p</i>	95% ci	df	SED	<i>t</i>
11 (3s)	8.0 (3s)	<0.0047	-1.67/-0.33	29	0.32	3.05
20 (2s)	7.0 (2s)					

Legend: N = number of patients, M = mean, *p* = *p* value, 95% CI = 95% confidence interval, df = degree of freedom, SED = standard error of difference, *t* = *t* value.

Table V. *t*-Student test of aesthetical evaluation (VAS) after one month according to the surgeon.

N	M	<i>p</i>	95% ci	df	SED	<i>t</i>
11 (3s)	7.0 (3s)	<0.0001	-2.25/-0.95	29	0.31	5.03
20 (2s)	5.4 (2s)					

Legend: N = number of patients, M = mean, *p* = *p* value, 95% CI = 95% confidence interval, df = degree of freedom, SED = standard error of difference, *t* = *t* value.

fer forehead skin of nasal thickness over a rigid, three-dimensional, sculptured, subsurface architecture, formed by primary and delayed primary cartilage grafts and soft-tissue excision before pedicle division and it ensures maximal vascular safety.

A disadvantage of the paramedian forehead flap is the lack of adequate length to reach and form the distal parts of the nose, such as the columella and ala, especially in patients with a short (usually < 3 inches) forehead⁷⁻⁹. In order to improve this traditional method, Feng Li et al¹⁰ performed the forehead flap as a split flap, and in an obliquely oriented fashion. Converse²¹ first described a scalping flap for nasal reconstruction, stressing its mobility as its main advantage and substantial donor-site morbidity as the main disadvantage. Other variations described were sickle flap, frontotemporal flap²² median and paramedi-

Table VI. *t*-Student test of aesthetical evaluation (VAS) after six month according to the surgeon.

N	M	<i>p</i>	95% ci	df	SED	<i>t</i>
11 (3s)	8.0 (3s)	<0.0001	-2.24/-1.16	29	0.263	6.47
20 (2s)	6.3 (2s)					

Legend: N = number of patients, M = mean, *p* = *p* value, 95% CI = 95% confidence interval, df = degree of freedom, SED = standard error of difference, *t* = *t* value.

an, subdermal-periosteal flap²³, and the more complicated island myoaponeurotic flap, proposed by Song et al²⁴. Furthermore part of the hairy scalp may also be included²² within the flap when this appears to be too short.

Tissue expansion of the forehead has been extensively reported in the literature for closure of the forehead defects after forehead flap elevation^{24,25-33}. Hoffman and Baker²⁴ used intraoperative forehead expansion, but Sasaki³² reported that rapidly expanded flaps have less vascularization compared with the regular tissue expansion method. The majority of the surgeons^{23,25-31} prefer to place the tissue expander under the galea and subsequently to inflate the expander for a few weeks before performing the reconstruction. Adamson²⁷ recommended subcutaneous expander insertion to achieve a thinner flap. Although some good results have been reported, there are substantial reported disadvantages in using tissue expanders: delay of reconstruction, higher risk of infection (alloplastic material), exposure²⁹, an extra surgical step for insertion, possible late shrinkage of the flap³³, temporary deformity of the forehead²³, difficulty in prelaminating the nose, possibility of achieving a flap that is too thick, and bleeding after stripping of the capsule³⁴.

Conclusion

The three-stage method for nasal reconstruction with a forehead flap, if compared to the two-stage one, allows to give a better three-dimensional structure to the transposed tissue as similar as possible to the real nose. In addition it ensures a maximal blood supply, a thin covering flap and controlled shaping³⁵⁻³⁸.

This technique is the supplementary operative time but it is completely rewarded by a improved aesthetic result and by minimal need for later revisions. In fact, all patients, who underwent reconstruction of the nose with the three-stage technique, showed a higher degree of satisfaction than those who underwent two-stage approach.

In our opinion this technique is better suited for defects including underlying structures such as bone or cartilage and particularly for all those defects located in the distal (tip and nostrils). In addition the three-stage forehead flap technique should be recommended for smokers patients to reduce the risk of forehead flap complications.

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