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Original Article

Functional and Aesthetic Comparison between Grafts and Local Flaps in Non-Melanoma Skin Cancer Surgery of the Face: A Cohort Study

Mario Faenza, Marcello Molle*, Vincenzo Mazzarella, Andrea Maria Antonetti, Francesco Giuseppe Filosa, Tommaso Pelella, Giovanni Francesco Nicoletti

Plastic Surgery Unit, Multidisciplinary Department of Medical-Surgical and Dental Specialties, Università degli Studi della Campania "Luigi Vanvitelli," Piazza Luigi Miraglia, 80138 Naples, Italy

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ABSTRACT

Background: Non-melanoma skin cancers represent more than 90 % of malignant skin tumors, with an incidence of 19.46 cases/100,000 people per year in Italy; however, their real incidence is underestimated. Although there are several therapeutic strategies, the only one that can guarantee a 95 % healing rate and the possibility of performing histological examination is surgical excision with subsequent reconstruction of the injured area with direct closure and with skin graft, local, regional, or free flaps in cases involving greater damage.

Material and Methods: Fifty-four patients underwent post-oncological head/face reconstructive surgery with skin graft or local flap between November 2021 and February 2023. The aesthetic outcomes (and the subsequent impact on the patients' lives) were assessed using the Vancouver Scar Scale, Manchester Scar Scale, and Visual Analog Scale with scars ranked by three independent surgeon observers.

Results: Patients who received reconstruction with local flaps demonstrated improved aesthetic and functional satisfaction, as well as improved aesthetic evaluation by independent surgeons.

* Corresponding Author: Marcello Molle, Plastic Surgery Unit, Multidisciplinary Department of Medical-Surgical and Dental Specialties, Università degli Studi della Campania "Luigi Vanvitelli," Piazza Luigi Miraglia, 80138 Naples, Italy.
E-mail address: marcello.molle@unicampania.it (M. Molle).

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Conclusions: The use of local flaps permits a more pleasing reconstruction (functionally and aesthetically) of post-oncological tissue defects of the face.

Key Points

Question: What is the best reconstruction technique for post-oncological defects in the head and neck area?
Findings: Reconstruction with local flaps is the most satisfactory technique.
Meaning: In post-oncological reconstruction of the head and neck area, the use of local flaps should be preferred over other techniques.

Introduction

Non-melanoma skin cancers (NMSC), basal cell carcinoma (BCC) primarily and squamous cell carcinoma (SCC) as one then, arise from epidermal keratinocytes and skin appendages. They represent more than 90 % of malignant skin tumors, their incidence is approximately 19.46 cases/100,000 people per year in Italy,[1] and ranging from 9 to 96 cases for every 100,000 inhabitants in Europe,[2] although their real incidence is underestimated.[3] In several countries, cancer registries do not encompass data on BCC and SCC owing to their low mortality rate,[4] the occasional diagnosis that often occurs over time from the onset, the poor traceability of the cancer, the low clinical relevance, and their treatment outside the national health system.[5]

The main risk factor associated with these tumors is cumulative Ultra Violet (UV) radiation exposure (especially UVB)[6] in childhood and youth, as it causes genetic damage through reactive oxygen compounds production and loss of heterozygosity of tumor suppressor genes.[7] Other exogenous factors involved are tobacco consumption, arsenic, vinyl chloride, polycyclic aromatic hydrocarbons, alkylated agents, exposure to petrol vapor,[8] and immunosuppression, including drug-induced therapies following organ transplantation (especially for SCC)[9] for chronic immune-mediated diseases or hematopoietic disorders, such as lymphoma or leukemia[1] while the main endogenous factor is represented by genodermatoses.[10]

The most frequent localizations are in the skin regions, such as face, scalp, arms, trunk and the lower limbs, that are exposed to the sun (especially in women).[11] In association with Human PapillomaVirus (HPV) infection, genital, perineal, and anal regions are often affected.[12,13]

The mortality in non-melanoma skin cancer is very rare owing to the low metastatic potential (usually in SCC[5]).

Treatment of NMSC is based on complete surgical excision[14,15] with histopathological assessment of resection margins, which can be performed via micrographic surgery (Mohs[16]) or via normal excision with safety margin (ranging from 2 to 5 mm in low-risk to 15 mm in high-risk BCC[17] and a minimum of 5 mm in low-risk and between 6 and 10 mm in high-risk SCC[1]). Surgical excision allows histological examination, confirmation of clinical diagnosis, and evaluation of surgical margins with high rates of effectiveness and healing rates of 95 %.[1,5] Alternatives to surgical removal are cryotherapy, curettage and electrocoagulation,[1] photodynamic therapy with ALA (5-Aminolevulinic acid) or Methyl aminolevulinate (MAL),[1,18] and topical agents (such as imiquimod 5 % or 3.75 %, diclofenac gel 3 %, ingenol mebutate 500 mcg/g, or 150 mcg/g)[1,19] for those locally advanced and/or metastatic medical treatment.[1,20] Although such nonsurgical therapeutic procedures do not permit any histo-

logical analysis, they may be considered when surgery is not feasible or preferred and tumors are low-risk, with the understanding that the cure rate may be lower.

The main concern after surgical treatment is the reconstruction of the affected area. This can be performed using different techniques (primary closure, skin grafting, local, regional, or free flaps), whose choice varies according to the affected area of the body and size of the primary lesion.[21] The use of a different technique can yield different aesthetic and functional outcomes and thus have a different impact on the patients' quality of life, especially in cancers located on the face.

The purpose of the study (conducted according to the principles of the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) statement[22]) was to assess the aesthetic outcome and resulting impact on the patients' life after reconstruction with skin graft or local flaps in patients with NMSC of the face.

Material and Methods

The study included patients who underwent reconstructive surgery for scalp/face NMSC at the UOC of Plastic, Reconstructive, and Aesthetic Surgery of the University Hospital "Luigi Vanvitelli" in Naples, Italy, between November 2021 and February 2023. Data, including demographic, anamnestic, and prognostic information, were collected from patient records. Sixty patients (38 men and 22 women) with significant ($\geq$2.5 cm^2) oncological substance losses on the head and face were enrolled. Among these, 30 patients (20 men and 10 women) had local flap reconstruction, and 30 patients (18 men and 12 women) underwent skin grafts. Surgeries were all performed by the first author. Patient characteristics (age, sex, weight, BMI, and skin phototype according to Fitzpatrick, and previous surgeries performed in the areas) were collected.

Exclusion criteria included not completing scar scales, loss during follow-up, substance losses $<$2.5 cm^2, patients operated on through ordinary hospitalization or day surgery, incompatible surgical techniques, and patient death. Six patients were excluded owing to loss during follow-up, resulting in a final population of 54 patients (34 men and 20 women) with 54 NMSC. Twenty-seven of these patients (19 men and 8 women) had local flap reconstruction, and 27 patients (15 men and 12 women) underwent skin grafts. Scar assessment was conducted at the 12-month follow-up.

Aesthetic and functional evaluations were conducted using the Vancouver Scar Scale (VSS),[23] Manchester Scar Scale (MSS),[24] and visual analog scale with scar rating (VAS)[25,26] questionnaires administered to the patient and an independent plastic surgeon after six months of follow-up. This assessment tool considers four characteristics: vascularity, height, pliability, and pigmentation with scores ranging from 0 to 13 (the higher the score the worse the scar quality; Table 1).

The MSS offers a distinct approach by incorporating an overall VAS score alongside the individual attribute assessments. This scale evaluates and categorizes scars based on seven parameters: scar color (ranging from perfect to gross mismatch with surrounding skin), skin texture (matte or shiny), relation to surrounding skin (ranging from flush to keloid), scar texture (normal to hard), margin clarity (distinct or indistinct), size ($<$1 cm, 1-5 cm, and $>$5 cm), and whether the scar is singular or multiple. The score ranges from 5 to 18.

The multidimensional VAS is a tool that scars across four dimensions: pigmentation, vascularity, acceptability, and observer comfort, in addition to contour assessment. By summing up the individual scores across these dimensions, an overall score is derived (5 to 50).

The VSS, MSS, and VAS scores were obtained for each surgical case:

1. VSS1, MSS1, and VAS1: Evaluation of scar quality by a first independent surgeon.
2. VSS2, MSS2, and VAS2: Evaluation of scar quality by a second independent surgeon.
3. VSS3, MSS3, and VAS3: Evaluation of scar quality by a third independent surgeon.

The average MSS, VSS, and VAS scores for patients undergoing skin graft and flap reconstructive surgery were calculated for statistical analysis using the student *t* paired test, considering the results to be statistically significant at $p<0.05$.

Table 1
VSS scale.[26]

Scar characteristic	Score
Vascularity	
Normal	0
Pink	1
Red	2
Purple	3
Pigmentation	
Normal	0
Hypopigmentation	1
Hyperpigmentation	2
Pliability	
Normal	0
Supple	1
Yelding	2
Firm	3
Ropes	4
Contracture	5
Height (mm)	
Flat	0
<2	1
2-5	2
>5	3
Total Score	13

Subsequently, we conducted an analysis of the outcomes based on the aesthetic subunits of the lesions. We divided the face into the following regions: frontal (12), periorbital (2), oral (2), nasal (2) maxillary and mandibular (8), auricular (12), and scalp (16 cases) (Table 1).

Results (Figures 1–7)

The study population of 54 patients was divided into two sub-populations: Group A, consisting of 27 patients (19 men and 8 women) treated with local flaps, and Group B, consisting of 27 patients (15 men and 12 women) treated with skin grafts. The average age of the patients was 74.94 years, and demographic data are presented in Table 2.

To compare the results between the two sub-populations, the student *t*-test was used to evaluate the differences in the averages of results.[27] A statistically significant difference was considered for t-values corresponding to $p<0.05$ with a 95 % confidence interval.

At VSS 1, the mean VSS score for Group A was 2.78 (SD = 1.22), while for Group B it was notably higher at 4.48 (SD = 1.78). This difference was statistically significant, with a mean difference of -1.70 (95 % CI: -2.54 to -0.87) and a p-value of 0.0001.

Similarly, at VSS 2, Group A had a mean VSS score of 2.74 (SD = 1.02), whereas Group B had a mean score of 4.26 (SD = 2.46). The mean difference was -1.52 (95 % CI: -2.63 to -0.41), with a significant p-value of 0.0092.

At VSS 3, the mean VAS score for Group A decreased to 2.52 (SD = 0.94), whereas for Group B it increased to 5.148 (SD = 1.94). The mean difference was -2.63 (95 % CI: -3.47 to -1.79), with a p-value of 0.0001, indicating a significant difference between the groups (Tables 3 and 6).

For MSS 1, Group A had a mean MSS score of 7.22 ± 1.55, whereas Group B had a significantly higher mean score of 9.67 ± 2.11 (p = 0.0001). Similarly, for MSS 2, Group A had a mean score of 7.22 ± 1.155, whereas Group B had a higher mean score of 9.44 ± 1.91 (p = 0.0001). For MSS 3, Group A had a mean score of 7.26 ± 1.318, and Group B had a slightly lower mean score of 8.36 ± 1.23, with a significant mean difference of -1.00 (p = 0.0057) (Tables 4 and 7).

For VAS 1, Group A had a mean score of 5.89 ± 1.5021, which was significantly higher than Group B with a mean score of 4.48 ± 1.7839 (p = 0.0062). Similarly, for VAS 2, Group A had a mean score

Table 2
Demographic data of population.

	Group A (Number of patients: 27; Number of lesions: 27)	Group B (Number of patients: 27; Number of lesions: 27)
Weight, kg		
Mean ± standard deviation	65.70 ± 7.461	69.44 ± 8.3405
Median	66	72
Age, years		
Mean ± standard deviation	73.56± 13.61	75.33 ± 9.64
Median	77	76
BMI, kg/m^2		
Mean± standard deviation	22.44 ± 3.588	24.67 ± 3.305
Median	22	25
Sex, n		
Male	19	15
Female	8	12
Fitzpatrick skin phototype		
I	1	0
II	13	15
III	11	10
IV	2	2
Facial subunit treated		
Frontal	6	6
Maxillary and Mandibular	5	5
Scalp	10	10
Ear	6	6
Previous surgeries performed	4	6
Non skin melanoma cancer excision	3 (2 scalp, 1 frontal, and 1 zigomatic)	5 (3 scalp and 2 frontal)
Melanoma excision	1 (other region)	1 (other region)
Other procedeures		
- Blepharoplasty	1	0
- Facelift	0	0
- Rhinoplasty	0	1

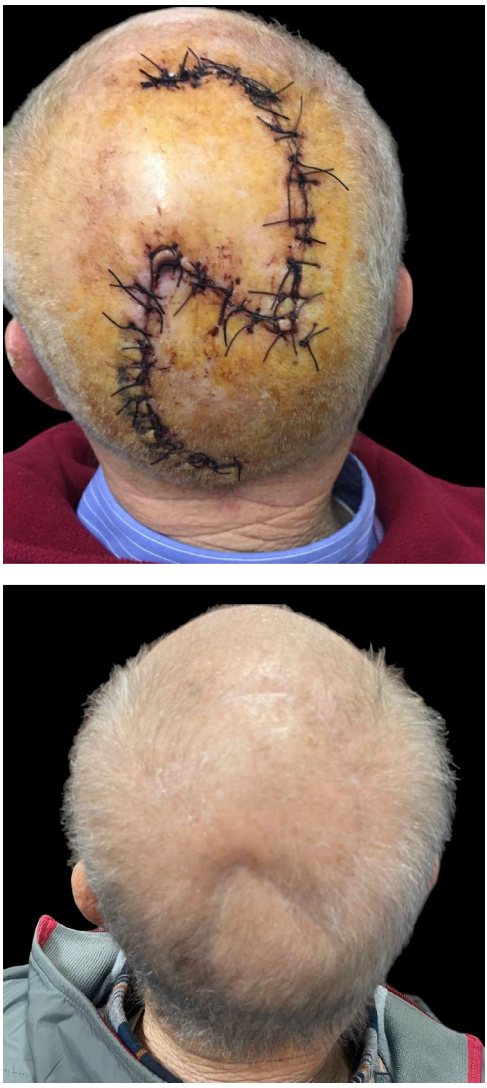
of 5.93 ± 1.4392, whereas Group B had a lower mean score of 4.26 ± 2.4588 ($p = 0.0068$). For VAS 3, Group A exhibited a mean score of 6.11 ± 1.2810, which was slightly higher than the Group B mean score of 5.148 ± 1.936, with a mean difference of 0.96 ($p = 0.0492$) (Tables 5 and 8).

Referring to the analysis by aesthetic subunits, we identified better values for the MSS and VVS scales for both the NMSC of the scalp and frontal skin cancers, whereas no statistically significant differences were identified for the lesions of the mandibular and maxillary area and for the lesions of the ear (Table 3, 4, 6, and 7). With reference to this subanal, the results of the VAS scale demonstrated a similar trend, but very rarely with statistical significance (Tables 5 and 8).

Discussion and Conclusions

The incidence of scalp/face skin cancer has increased rapidly worldwide over the last decade owing to extended life spans, social, and medical changes.[28]

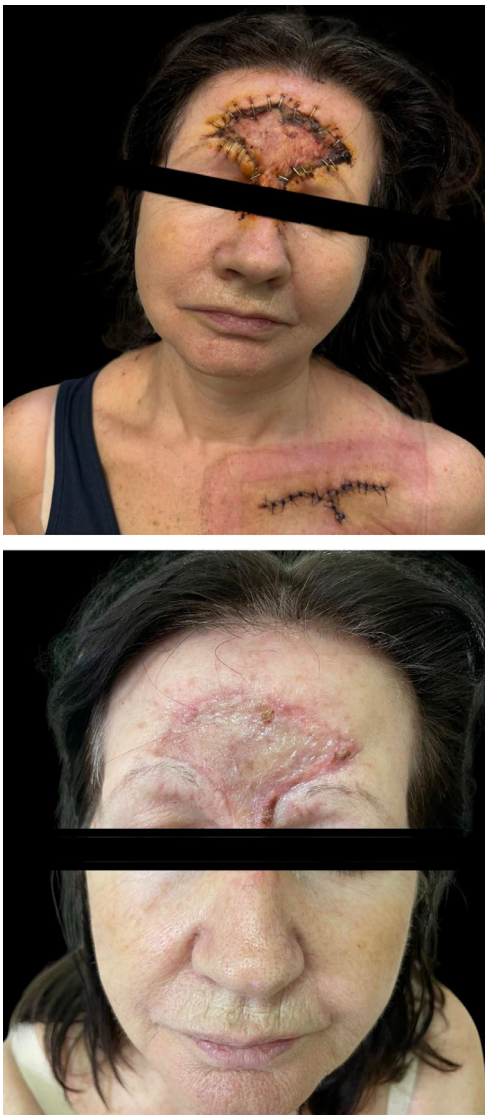
Despite the several methods available for the treatment of non-melanoma skin cancer, the only one that allows to perform histological analysis and to accurately assess if the margins of the lesion are free of malignant cells is complete surgical excision. The reconstruction alternative after the removal of the primary defect are primary closure, local flap, and skin graft. Factors that make the surgeons choose one technique over the others are influenced by location of the defect, tumor size and type, possibility of recurrence, patient age, performance status, functional result, and cosmetic outcome. The simplest reconstructive method for small defect is primary closure, that has the advantage of leaving a smaller scar, when distributed along the Langer's lines to reduce tension, and faster healing. When the defect is larger the surgeon is usually unable to reconstruct it using a direct closure because of the



Figures 1. and 2. Postoperative and follow-up photographs of an SCC of scalp reconstructed with double rotation local flaps (patient n°23, group A).

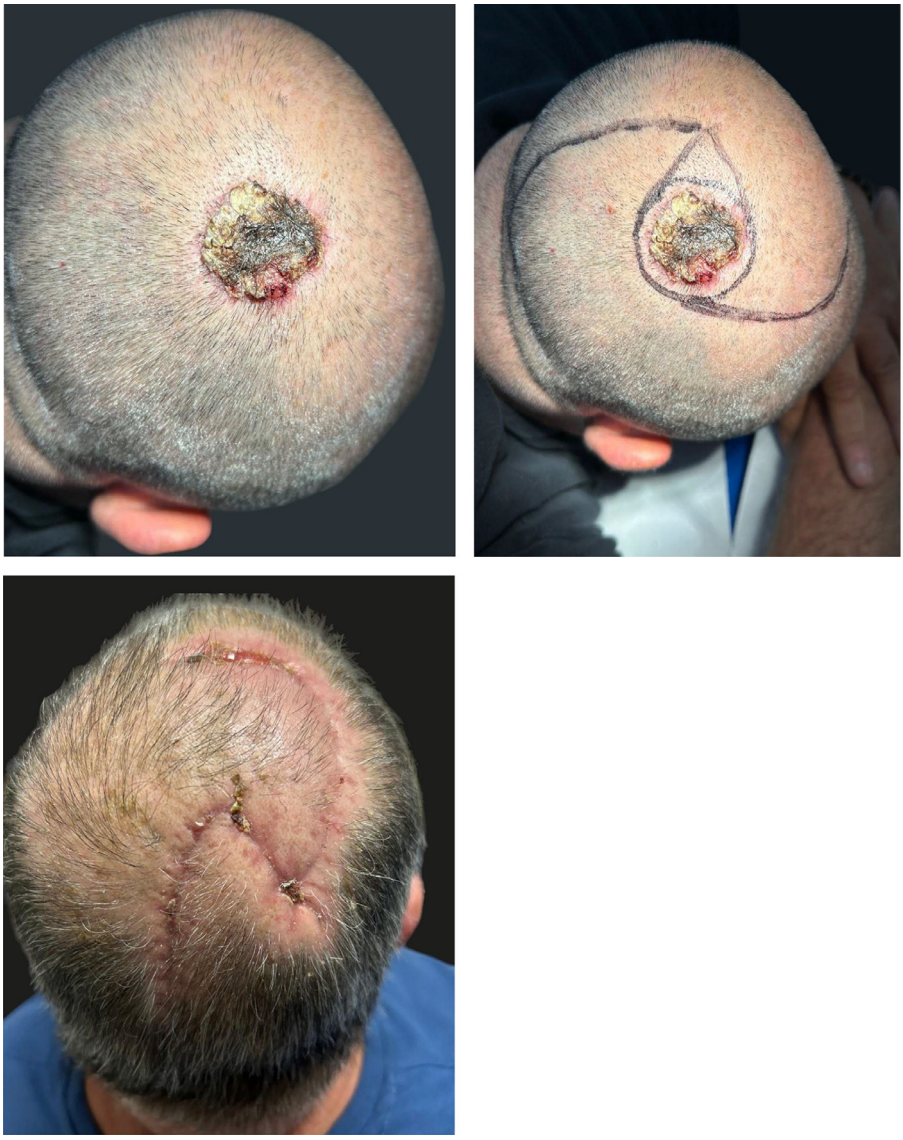
formation of dog ears in the final portion of the scar and the consequent deformity in the surrounding structures that occurs often.

In these cases, in order not to lengthen the scar further and to prevent tissue deformity, it is necessary to use other reconstruction techniques such as skin grafts or local flaps. Skin grafts are especially useful for the nasal tip, lower eyelid, temporal region, forehead, cheek, and scalp. Advantages to using a skin graft are the speed of execution, coverage of deep layers, and above all the easy detection of a possible tumor recurrence; however, it is difficult to harmonize the graft with the color and texture of the surrounding tissues. Moreover, there is tendency of retraction according to its type and during curing it may leave scars with plate-like form.[29]



Figures 3. and 4. Postoperative and follow-up photographs of a BCC of frontal with full thickness skin graft (patient n°21, group B).

Because of the presence of numerous pilosebaceous units and a well-developed neurovascular system, the face usually recovers fast after surgery with less chance of scar occurrence. These characteristics, together with the presence of excess skin (especially in older adults), make it easier to use local flaps for face skin cancer reconstruction. The main advantage of a flap is that it can provide a better cosmetic outcome using the surrounding defect tissue within the same aesthetic unit as the harvesting flap site having a similar color, texture, thickness, elasticity, and sebaceous gland density to the defect area and with a higher survival rate compared to that of a skin graft.[30] However, a flap requires an additional incision and movement of tissue, and if the skin incision is not performed



Figures 5. 6, and 7. Preoperative, planning, and immediate postoperative photographs of a SCC of scalp reconstructed with double rotation local flaps (patient 18, group A).

through the skin tension line, an inappropriate scar may persist.[31] Different types of flaps may be used depending on the location of the area to be reconstructed and the presence of excess skin in the areas surrounding the lesion,[32] and it is essential to select the correct type of flap to make the scars coincide with the Langer's lines[32] and above all respecting the aesthetic units[33] of the face to achieve the best aesthetic result possible.

Our results showed better cosmetic and functional performance when using local flaps than skin grafts (either full-thickness or partial-thickness) in the reconstruction of defects due to non-melanoma skin cancer of the scalp and frontal region. Although comparable results were obtained in lesions of

Table 3
VSS scores.

Group A					Group B				
Patients	Age, years	VSS 1	VSS 2	VSS 3	Patients	Age, years	VSS 1	VSS 2	VSS 3
1 ♂ (ear)	87	4	3	4	1 ♀ (ear)	59	3	4	6
2 ♀ (scalp)	48	4	3	3	2 ♂ (scalp)	85	4	5	5
3 ♂ (ear)	82	3	2	3	3 ♀ (ear)	70	2	2	4
4 ♂ (scalp)	66	2	3	2	4 ♂ (scalp)	76	6	5	7
5 ♂ (maxillary, mandibular)	85	3	2	3	5 ♂ (maxillary, mandibular)	63	5	5	5
6 ♀ (frontal)	88	0	1	1	6 ♂ (frontal)	82	3	1	4
7 ♂ (maxillary, mandibular)	79	4	2	2	7 ♀ (maxillary, mandibular)	80	3	4	4
8 ♀ (scalp)	55	3	2	2	8 ♂ (scalp)	77	4	5	7
9 ♀ (ocular, periorbital)	45	5	2	3	9 ♂ (ocular, periorbital)	84	4	5	5
10 ♀ (frontal)	80	2	2	2	10 ♀ (frontal)	84	4	5	2
11 ♂ (ear)	52	2	3	2	11 ♂ (ear)	56	6	2	4
12 ♀ (nose)	64	1	3	1	12 ♀ (nose)	74	4	4	8
13 ♀ (frontal)	84	3	2	4	13 ♀ (frontal)	82	7	8	7
14 ♂ (scalp)	76	4	2	3	14 ♂ (scalp)	73	4	8	5
15 ♂ (ear)	70	3	2	3	15 ♀ (ear)	74	3	1	8
16 ♂ (maxillary, mandibular)	73	4	3	4	16 ♀ (maxillary, mandibular)	72	3	8	7
17 ♂(frontal)	83	2	3	2	17 ♂ (frontal)	85	4	8	6
18 ♂ (scalp)	60	2	1	2	18 ♂ (scalp)	62	6	5	4
19 ♂ (maxillary, mandinular)	80	1	3	1	19 ♀ (maxillary, mandibular)	78	6	6	3
20 ♀ (frontal)	86	1	2	2	20 ♂ (frontal)	76	7	4	8
21 ♂ (frontal)	74	2	3	2	21 ♀(frontal)	69	7	2	7
22 ♂ (scalp)	86	2	3	2	22 ♂ (scalp)	86	6	7	6
23 ♂ (scalp)	77	3	4	3	23 ♂ (scalp)	77	7	1	2
24 ♂ (oral,lips)	90	4	5	4	24 ♀ (oral, lips)	90	5	1	6
25 ♂ (ear)	53	3	4	2	25 ♂ (ear)	60	1	1	3
26 ♂ (ear)	73	4	5	4	26 ♀ (ear)	68	1	7	1
27 ♂ (scalp)	90	4	4	2	27 ♂ (scalp)	92	6	1	5
Mean	**74.1**	**2.78**	**2.74**	**2.52**	**Mean**	**75,78**	**4.48**	**4.26**	**5.15**

the mandibular and maxillary regions and ears. It was not possible to perform a subanalysis of the reconstructed lesions in the periorbital, periocular, and nose aesthetics subunits because of the small number of lesions detected in these areas.

The results obtained can be explained by the characteristics of the different areas and small numbers of some subunits analyzed, which may have affected the ability to obtain statistically significant results. One limitation of our study may be attributed to the small number of patients, which was necessary to ensure a cohort with enough uniformity of treatment to compare the reconstructions performed (same operator, similar areas, and populations between groups). Another limitation was due to the failure to use blinding in the evaluation of results, which is not applicable given the very nature of the study. The surgical treatment of non-melanoma skin cancer lesions of the face can be burdened by considerable psychological stress due to the aesthetic, social, and identity values placed on the face.[34] Therefore, it becomes important to guarantee constant research to achieve the best aesthetic and functional outcomes. Although there are numerous studies in the literature that evaluate the aesthetic outcomes of various techniques in the surgical treatment of these areas,[35-37] they focused only on one technique or on one aesthetic subunit and did not approach the face in its entirety by comparing different techniques.

The choice of local flaps, specifically harvested from the same facial aesthetic unit where the lesion is situated, emerged as a preferred option, in terms of functional and aesthetic considerations.

Acknowledging the transformative potential of local flaps, this approach aligns with the goal of not just closing the defect but also contributing to a harmonious and aesthetically pleasing appearance within the facial context. The localized nature of flaps allows for a more tailored and integrated reconstruction, enhancing form and function.

Table 4
MSS scores.

Group A					Group B				
Patients	Age, years	MSS 1	MSS 2	MSS 3	Patients	Age. years	MSS 1	MSS 2	MSS 3
1 ♂ (ear)	87	8	8	9	1 ♀ (ear)	59	8	9	7
2 ♀ (scalp)	48	8	8	7	2 ♂ (scalp)	85	9	8	7
3 ♂ (ear)	82	7	6	7	3 ♀ (ear)	70	10	9	8
4 ♂ (scalp)	66	6	7	6	4 ♂ (scalp)	76	11	10	9
5 ♂ (maxillary, mandibular)	85	8	8	8	5 ♂ (maxillary, mandibular)	63	10	9	8
6 ♀ (frontal)	88	5	5	9	6 ♂ (frontal)	82	8	9	7
7 ♂ (maxillary, mandibular)	79	10	7	6	7 ♀ (maxillary, mandibular)	80	8	9	7
8 ♀ (scalp)	55	8	8	6	8 ♂ (scalp)	77	10	10	7
9 ♀ (ocular, periorbital)	45	9	7	7	9 ♂ (ocular, periorbital)	84	10	11	8
10 ♀ (frontal)	80	7	8	6	10 ♀ (frontal)	84	10	10	8
11 ♂ (ear)	52	6	6	6	11 ♂ (ear)	56	8	7	8
12 ♀ (nose)	64	5	6	5	12 ♀ (nose)	74	7	8	8
13 ♀ (frontal)	84	8	7	9	13 ♀ (frontal)	82	13	13	11
14 ♂ (scalp)	76	9	6	8	14 ♂ (scalp)	73	8	10	11
15 ♂ (ear)	70	8	7	8	15 ♀ (ear)	74	8	5	7
16 ♂ (maxillary, mandibular)	73	10	8	9	16 ♀ (maxillary, mandibular)	72	8	10	8
17 ♂(frontal)	83	6	6	7	17 ♂ (frontal)	85	9	10	8
18 ♂ (scalp)	60	6	6	6	18 ♂ (scalp)	62	11	12	9
19 ♂ (maxillary, mandinular)	80	5	6	5	19 ♀ (maxillary, mandibular)	78	10	11	9
20 ♀ (frontal)	86	5	7	7	20 ♂ (frontal)	76	13	11	9
21 ♂ (frontal)	74	6	7	7	21 ♀(frontal)	69	13	11	10
22 ♂ (scalp)	86	6	7	7	22 ♂ (scalp)	86	13	12	9
23 ♂ (scalp)	77	7	8	8	23 ♂ (scalp)	77	13	10	9
24 ♂ (oral,lips)	90	8	9	9	24 ♀ (oral, lips)	90	8	7	7
25 ♂ (ear)	53	6	9	7	25 ♂ (ear)	60	6	6	7
26 ♂ (ear)	73	9	10	10	26 ♀ (ear)	68	7	7	7
27 ♂ (scalp)	90	9	8	7	27 ♂ (scalp)	92	12	11	10
Mean	**74.1**	**7,22**	**7,22**	**7,26**	**Mean**	**75,78**	**9.67**	**9.44**	**8.26**

Table 5
VAS scores.

Group A					Group B				
Patients	Age, years	VAS 1	VAS 2	VAS 3	Patients	Age, years	VAS 1	VAS 2	VAS 3
1 ♂ (ear)	87	5	4	6	1 ♀ (ear)	59	3	4	6
2 ♀ (scalp)	48	7	7	6	2 ♂ (scalp)	85	4	5	5
3 ♂ (ear)	82	4	5	4	3 ♀ (ear)	70	2	2	4
4 ♂ (scalp)	66	5	6	5	4 ♂ (scalp)	76	6	5	7
5 ♂ (maxillary, mandibular)	85	3	3	6	5 ♂ (maxillary, mandibular)	63	5	5	5
6 ♀ (frontal)	88	6	6	6	6 ♂ (frontal)	82	3	1	4
7 ♂ (maxillary, mandibular)	79	8	8	7	7 ♀ (maxillary, mandibular)	80	3	4	4
8 ♀ (scalp)	55	6	6	5	8 ♂ (scalp)	77	4	5	7
9 ♀ (ocular, periorbital)	45	7	6	5	9 ♂ (ocular, periorbital)	84	4	5	5
10 ♀ (frontal)	80	3	3	4	10 ♀ (frontal)	84	4	5	2
11 ♂ (ear)	52	5	5	7	11 ♂ (ear)	56	6	2	4
12 ♀ (nose)	64	5	5	4	12 ♀ (nose)	74	4	4	8
13 ♀ (frontal)	84	6	5	8	13 ♀ (frontal)	82	7	8	7
14 ♂ (scalp)	76	8	7	7	14 ♂ (scalp)	73	4	8	5
15 ♂ (ear)	70	6	7	6	15 ♀ (ear)	74	3	1	8
16 ♂ (maxillary, mandibular)	73	5	6	6	16 ♀ (maxillary, mandibular)	72	3	8	7
17 ♂(frontal)	83	7	6	8	17 ♂ (frontal)	85	4	8	6
18 ♂ (scalp)	60	4	4	6	18 ♂ (scalp)	62	6	5	4
19 ♂ (maxillary, mandinular)	80	5	5	5	19 ♀ (maxillary, mandibular)	78	6	6	3
20 ♀ (frontal)	86	6	6	7	20 ♂ (frontal)	76	7	4	8
21 ♂ (frontal)	74	9	6	5	21 ♀(frontal)	69	7	2	7
22 ♂ (scalp)	86	5	9	6	22 ♂ (scalp)	86	6	7	6
23 ♂ (scalp)	77	6	7	6	23 ♂ (scalp)	77	7	1	2
24 ♂ (oral,lips)	90	6	8	7	24 ♀ (oral, lips)	90	5	1	6
25 ♂ (ear)	53	8	7	6	25 ♂ (ear)	60	1	1	3
26 ♂ (ear)	73	7	7	9	26 ♀ (ear)	68	1	7	1
27 ♂ (scalp)	90	7	6	8	27 ♂ (scalp)	92	6	1	5
Mean	**74.1**	**5.89**	**5.93**	**6.11**	**Mean**	**75,78**	**4.48**	**4.26**	**5.15**

Table 6
Results VSS scores.

	VSS 1		VSS 2		VSS 3	
	Group A	Group B	Group A	Group B	Group A	Group B
Sample size	27	27	27	27	27	27
Mean	2.78	4.48	2.74	4.26	2.52	5.148
Standard deviation	1.2195	1.7839	1.022538	2.4588	0.935224	1.936
Mean difference (95 % CI)	-1.70 (-2.54; -0.87)		-1.52 (-2.63; -0.41)		-2.63 (-3.47; -1.79)	
t-value	4.0968		2.8118		6.4069	
Standard error of difference	0.416		0.540		0.411	
p-value	0.0001		0.0092		0.0001	
Scalp	8	8	8	8	8	8
Mean difference (95 % CI)	-2.38 (-3.92; -0.83)		-1.88 (-4.61; 0.86)		-2.75 (-4.41; -1.09)	
t-test	3.64		1.62		3.92	
Standard error of difference	0.65		1.16		0.701	
p-value	0.0083		0.15		0.0057	
Frontal	6	6	6	6	6	6
Mean difference (95 % CI)	-3.67 (-5.83; -1.95)		-2.5 (-5.36; 0.37)		-3.5 (-5.68; -1.32)	
t-test	5.5		2.24		4.13	
Standard error of difference	0.67		1.12		0.85	
p-value	0.0027		0.76		0.09	
Ear	6	6	6	6	6	6
Mean difference (95 %CI)	0.50 (-2.05; 3.05)		0.33 (-1.50; 2.17)		-1.33 (-4.04; 1.38)	
t-test	0.50		0.47		1.26	
Standard error of difference	0.0992		0.715		1.054	
p-value	0.6355		0.6606		0.26	
Maxillary and mandibular	4	4	4	4	4	4
Mean difference (95 %CI)	-1.25 (-5.82; 3.32)		-3.25 (-5.25;-1.25)		-2.25 (-3.05;-1,45)	
t-test	0.8704		5.1657		9	
Standard error of difference	1.436		0.629		0.250	
p-value	0.4481		0.0141		0.0029	

Table 7
Results MSS scores.

	MSS 1		MSS 2		MSS 3	
	Group A	Group B	Group A	Group B	Group A	Group B
Sample size	27	27	27	27	27	27
Mean	7.22	9.67	7.22	9.44	7.26	8.36
Standard deviation	1.55	2.11	1.155	1.91	1,318	1.23
Mean difference (95 % CI)	-2.44 (-3.46; -1.43)		-2.22 (-3.08; -1.36)		-1.00 (-1.70; -0.30)	
t value	4.8454		5.1773		2.8845	
Standard error of difference	0.504		0.429		0.347	
p-value	0.0001		0.0001		0.0057	
Scalp	8	8	8	8	8	8
Mean difference (95 %CI)	-3.50 (-5.78; -1.22)		-3.13 (-4.70; -1.55)		-2 (-3; -1)	
t-test	3.63		4.69		4.73	
Standard error of difference	0.964		0.666		0.423	
p-value	0.0084		0.0022		0.0021	
Frontal	6	6	6	6	6	6
Mean difference (95 % CI)	-4.83 (-7-17; -2.49)		-4 (-5.33; -2.67)		-1.33 (-3.17; 0.5)	
t-test	5.31		7.74		1.87	
Standard error of difference	0.91		0.516		0.715	
p-value	0.0032		0.0006		0.1212	
Ear	6	6	6	6	6	6
Mean difference (95 %CI)	-0.50 (-2.35; 1.35)		0.50 (-2.13; 3.13)		0.50 (-1.46; 2.46)	
t-test	0.6956		0.4880		0.655	
Standard error of difference	0.719		1.025		0.764	
p-value	0.5177		0.6462		0.542	
Maxillary and mandibular	4	4	4	4	4	4
Mean difference (95 % CI)	-0.75 (-6.17; 4.67)		-2.50 (-5.26; 0.26)		-1 (-4.44; 2.44)	
t-test	0.44		2.89		0.93	
Standard error of difference	1.70		0.866		0.93	
p-value	0.69		0.0632		0.4228	

Table 8
Results VAS scores.

	VAS 1		VAS 2		VAS 3	
VAS 1	Group A	Group B	Group A	Group B	Group A	Group B
Sample size	27	27	27	27	27	27
Mean	5,89	4.48	5.93	4.26	6.11	5.148
Standard deviation	1.5021	1.7839	1.4392	2.4588	1.2810	1.936
Mean difference (95 % CI)	1.41 (0.44; 2.38)		1.67 (0.50; 2.83)		0.96 (0.01; 1.92)	
t-test	2.9806		2.9374		2.063	
Standard error of difference	0.472		0.567		0.467	
p-value	0.0062		0.0068		0.0492	
Scalp	8	8	8	8	8	8
Mean difference (95 % CI)	0.63 (-1.21; 2.46)		1.88 (-0.24; 3.99)		1 (-0.84; 2.84)	
t-test	0.8036		2.0946		1.2834	
Standard error of difference	0.778		0.895		0.779	
p-value	0.4481		0.0745		0.2402	
Frontal	6	6	6	6	6	6
Mean difference (95 % CI)	0.83 (-1.31; 2.98)		0.67 (-2.95; 4.28)		0.67 (-1.17; 2.5)	
t-test	1		0.474		0.9325	
Standard error of difference	0.833		1.406		0.715	
p-value	0.3632		0.654		0.3939	
Ear	6	6	6	6	6	6
Mean difference (95 % CI)	3.17 (0.10; 6.24)		3 (0.18; 5.82)		2 (-1.70; 5.70)	
t-test	2.65		2.7386		1.3912	
Standard error of difference	1.195		1.095		1.438	
p-value	0.0454		0.0409		0.22	
Maxillary and mandibular	4	4	4	4	4	4
Mean difference (95 % CI)	1 (-4.03; 6.03)		-0.25 (-4.82; 4.32)		1.25 (-1.47; 3.97)	
t-test	0.6325		0.17		1.4639	
Standard error of difference	1.58		1.436		0.854	
p-value	0.5720		0.8729		0.2394	

Ethics approvals

The study was exempted from the need for approval by our local ethics committee.

Declaration of Competing Interest

We have no conflict of interests to disclosure.

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Patient consent

The patients consented to the publication of the cases.

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