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Reconstruction of Facial Skin Defects with Flap and Graft Techniques: A Comparative Study

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Abstract

Background: Reconstruction of facial skin defects is challenging. Skin flaps and grafts are well-known techniques for reconstructing these defects. The outcomes of the surgeries can vary depending on the surgical procedures and the patient's characteristics.

Objectives: This study aimed to compare the results of reconstructing facial skin defects using skin grafts and flaps in patients referred to Imam Reza Hospital, Birjand, Iran.

Methods: This quasi-experimental study was performed on 100 patients with tumors and traumatic lesions in the facial area referred to the plastic surgery service of Imam Reza Hospital, Birjand, Iran. For comparison, the data of 50 patients with skin grafts and 50 patients with flaps who underwent facial skin defect repair surgery were collected. Patients' demographic characteristics were extracted from their hospital records. The final reconstruction results were evaluated based on the presence or absence of aesthetic or functional complications three months after surgery.

Results: The mean ages of participants were 64.6±14.0 and 58.3±19.1 in the flap and graft groups, respectively. Women comprised 26 (52%) of the flap and 22 (44%) of the graft groups. The mean size of lesions in the graft group was 21.3±17.3 cm and 4.7±3.9 cm in the flap group (P=0.001). The frequency of aesthetic and functional complications in the flap group was 13 (26%) and 9 (18%), and in the graft group was 24 (48%) and 15 (30%), respectively. The frequency of aesthetic complications in the flap group was significantly lower than that in the graft group (P=0.023). There was no significant difference between the two groups in terms of the frequency of functional complications (P=0.160). The frequency of disease recurrence was not significantly related to surgical technique (P=0.749). Furthermore, the lesion location had a significant association with the surgical technique (P=0.009); however, the number of surgeries had no significant association with the surgical technique (P=0.389).

Conclusion: In general, except for when there is an indication for using a method, the reconstruction of facial skin defects using a skin flap will have better results than a skin graft.

Keywords: Dermatologic surgical procedures, Postoperative complications, Reconstructive surgical procedures, Skin transplantation, Surgical flaps

1. Background

Skin defects are among the most common causes of reconstructive surgery. Although these defects can occur all over the body, repairing skin defects on the face is more challenging due to the sensitivity to the aesthetic aspect (1). In addition to the aesthetic element, repairing these defects may be associated with functional impairments, such as impaired eyelid closure, lip functional disorders, and nasal airway obstruction (2, 3). Numerous factors, including tumor resection and trauma, can lead to these defects (4). Based on the size and location of the defect, it is necessary to use different methods to reconstruct the defects; therefore, the final result is acceptable to the patient in terms of function and beauty (5, 6).

Primary closure, locoregional flap, and skin graft are the main approved methods for reconstructing skin defects. Primary closure is the best option if the skin defect is minor and can be done without distorting the adjacent structures, leading to a smaller scar and faster healing (7). In moderate skin defects, the flap technique is preferred. In the flap technique, the adjacent tissue is used to repair the lesion while it remains connected to its original blood supply (8). This technique has good aesthetic results and texture coordination. Using the flap technique to reconstruct the surgical resection lesion is more accessible and less likely to fail than the skin graft technique (9). However, it has limitations, such as causing deformity and large scars due to additional incisions, tissue necrosis due to perfusion disorders, and the risk of further surgery (9-11). In the skin graft technique, split or full full-thickness is harvested from the donor site and transferred to the recipient site (8). Compared to the flap, the skin graft has advantages in some aspects, such as performing a one-stage surgery and being used to reconstruct more extensive and complex defects (11). This technique enables the reconstruction of a wide range of facial skin, especially for the nose tip, lower eyelid, forehead, temporal, and chin areas (9). Adjustment between color, texture, and thickness is the most prominent challenge of the skin graft technique. A

mismatch of the subunits around the reconstruction in skin grafts can lead to skin deviation and distortion by contraction (12). These factors can increase postoperative complications.

The outcomes of reconstructive surgery can vary from person to person. The patients' characteristics, lesion characteristics, and surgeon's preference should be considered when choosing the reconstructive surgery technique (12). The characteristics of people's skin differ from each other according to ethnicity, race, and living environment, which should be considered in choosing the appropriate treatment method (13-15). However, few studies have been conducted in Iran to evaluate the results of reconstructive facial skin surgeries. Ebrahimi et al. (16), in their study in Iran, stated that two weeks after the reconstruction of skin defects, patient satisfaction, color, and texture harmony in the flap method are significantly higher than those in the graft method. However, one year after reconstruction, there was no significant difference between the two groups regarding tissue coordination and patient satisfaction. Other studies, including Jacobs et al. (11) and Lee et al. (9), showed that the flap method has a significantly better aesthetic result in the long-term follow-up than skin graft in reconstructing lesions. These conflicting results and the lack of similar studies in Iran led us to compare these two methods of reconstructing skin lesions. This study can provide a better overview of the situation and outcome of facial reconstructive surgeries in Birjand, Iran.

2. Objectives

This study was conducted to compare the reconstruction of facial skin defects with flap and graft techniques in patients referred to Imam Reza Hospital, Birjand, Iran.

3. Methods

3.1. Study design and participants

This quasi-experimental study was performed in 2019-2020 at Imam Reza Hospital, affiliated with Birjand University of Medical Sciences, Birjand, Iran. This study was conducted after the approval of the Ethics Committee in Biomedical Research of Birjand University of Medical Sciences, Birjand, Iran (Ethics Code: IR.BUMS.REC.1397.087). The study population included patients referred to the plastic surgery service of Imam Reza Hospital, Birjand, Iran. Inclusion criteria were patients with facial tumor lesions who required surgical resection or traumatic facial defects that required reconstruction. On the other hand, patients whose traumatic wounds could be repaired with initial healing, those who did not return for follow-up evaluation after surgery, and the individuals whose information was incomplete were excluded from the study. The participants were selected by non-random convenience sampling method from the referring patients.

The required sample size was calculated using the formula

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 [p1(1-p1)+p2(1-p2)]}{(p1-p2)^2}$$

and according to the result of the study by Rustemeyer et al. (17), considering P1=0.12 and P2=0.39, the sample size was estimated at least 50 patients for each group. The objectives and method of the study were fully explained to the patients or their first-degree companions, and they were assured that participating in the study would not affect their treatment process. Informed consent was obtained from them before participating in the study. The patients underwent reconstructive surgery based on the most suitable repair method, which was selected based on the valid references of plastic surgery and the surgeon's opinion, using a flap or skin graft, and their information was recorded. The collection of patients' information in both flap and graft groups continued until each group reached 50 patients. In other words, the decision to place a patient in each of these two groups was not random and was based on the appropriate treatment that the surgeon thought should be done for him. All patients received routine preoperative care, no changes were made to their treatment plan, and no additional costs were imposed. Patients could voluntarily withdraw from the study at any stage. The patients' extraction information remained confidential throughout the study.

3.2. Intervention and measurements

In the graft group, reconstruction was performed using full or partial-thickness skin graft (Figure 1). In the flap group, reconstruction was performed using locoregional flaps (Figure 2). All patients were operated on by one experienced plastic surgeon. After surgery, patients underwent routine care until discharge and received the required pre-discharge care recommendations. Demographic characteristics and pathology reports were extracted from the patients' records. The surgeon determined information about the location of the skin lesion, traumatic injury, and defect. The size of the lesions was measured in millimeters using a ruler. The surgery type and duration were extracted from the patient's surgery reports. The surgery's final aesthetic and functional results were evaluated and recorded by the surgeon three months after surgery. Postoperative functional disorders include abnormalities in the opening or closing of the eyelids, ectropion, entropion, epiphora, dry eye, respiratory distress due to the narrowing of the internal or external nasal valve, microstomia, drooling, nerve

Figure 1. A patient with squamous cell carcinoma of the right temporoparietal region was reconstructed with a partial thickness skin graft. (A) Preoperative photograph. (B) Intraoperative photograp after excision of the tumor. (C) Postoperative photograph

injuries, and facial movement disorders. Any discoloration between the repair site and adjacent tissue, pin cushioning or depression of adjacent tissue, retraction of the nasal ala, or notching in the vermilion or lip or nasal contour was considered an aesthetic disorder. The plastic surgeon assessed these complications based on the above criteria and by considering the patients' opinions. The data were compared between the two surgical groups (i.e., flap and graft surgery).

3.3. Statistical analysis

Software (version 18). Descriptive results were reported as mean±standard deviation (SD), and relative frequency distribution. The normality of the data was evaluated by the Kolmogorov-Smirnov test. Due to the non-normality of the data, Mann-Whitney and Chi-square tests were used for analysis. The level of significance in all tests was considered P≤0.05.

4. Results

A total of 100 participants were included in the study in two groups of 50 people. The mean ages (+SD) of the participants in the flap and graft groups were 64.6±14.0 and 58.3±19.1, respectively (P=0.061). In the flap group, the number of men and women was 24 (48%) and 26 (52%), respectively, and in the graft group, it was 28 (56%) and 22 (44%), respectively (P=0.423). Table 1 shows lesion characteristics according to the surgical technique. The relative frequency of lesion type was not significantly different between the two groups. According to the Mann-Whitney statistical test, this difference between the two groups is statistically significant (P=0.001). The mean size of lesions was significantly larger in the graft (P=0.001). Moreover, Table 1 showed that the relative frequency of the lesion site had a significant relationship with the surgical technique (P=0.009). In the forehead, scalp, zygoma, temporal, and around the ear, the repair of the lesion by the graft was more than that by the flap.

In the cheek, nose, canthus of the eye, eyelids, jowl, and lips, the reconstruction of the lesion by the flap was more than that by the graft.

According to Table 2, the Mann-Whitney test result showed that the surgery duration in the flap group was significantly less than that in the graft group (P=0.001). The relative frequency of esthetic complications (contour deformity) in the group of patients who underwent skin flap reconstruction was significantly lower than that in the group who underwent skin grafting. Furthermore, the results of this study showed that the frequency of functional complications of patients had no significant relationship with the surgical technique. The number of required surgeries was not significantly different between the flap and graft groups (P=0.389). The results of this study showed that the relative frequency of disease recurrence in patients had no significant relationship with the surgical technique (P=0.749).

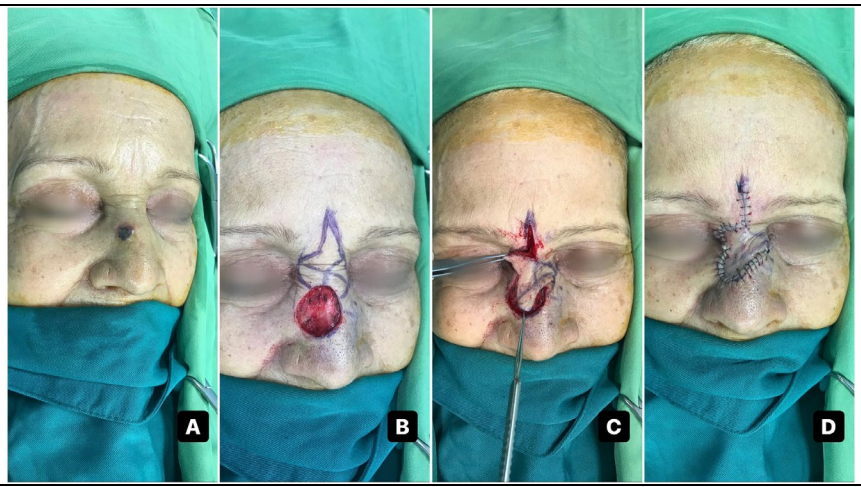

Figure 2. A patient with a basal cell carcinoma defect of the nose was reconstructed with the flap technique. (B) Intraoperative photograph after the excision of the tumor. (C) Reconstruction using a bi-lobe flap. (D) Postoperative photograph

Table 1. Comparison of lesion characteristics according to the surgical technique

Characteristics		Flap n (%)	Graft n (%)	Total n (%)	*P*-Value
Lesion type	BCC	31 (62)	22 (44)	53 (53)	*0.156
	SCC	7 (14)	16 (32)	23 (23)	
	Trauma	4 (8)	5 (10)	9 (9)	
	Other	8 (16)	7 (14)	15 (15)	
lesion site	Forehead and scalp	5 (10)	11 (22)	16 (16)	*0.009
	Temporal and zygoma	2 (4)	9 (18)	11 (11)	
	Buccal	14 (28)	6 (12)	20 (20)	
	Nose	15 (30)	9 (18)	24 (24)	
	Around the ears	0 (0)	5 (10)	5 (5)	
	Eye cantos and eyelids	8 (16)	5 (10)	13 (13)	
	Mandible and lips	6 (12)	5 (10)	11 (11)	
Lesion size (cm³)		4.7±3.9	21.3±17.3	13.0±15.0	**0.001

The data are given as a number (n), percentage (%), and mean±standard deviation (SD)
BCC: Basal Cell Carcinoma; SCC: Squamous Cell Carcinoma
*Chi-square test; **Mann-Whitney test

Table 2. Comparison of surgical complications and duration according to the surgical technique

Characteristics		Flap n (%)	Graft n (%)	Total n (%)	*P*-Value
Surgery duration (min)		62.2±25.2	84.4±33.5	73.5±31.5	*0.001
Esthetic complications	Yes	13 (26)	24 (48)	37 (37)	**0.023
	No	37 (74)	26 (52)	63 (63)	
Functional complication	Yes	9 (18)	15 (30)	24 (24)	**0.160
	No	41 (82)	35 (70)	76 (76)	
Recurrence	Yes	5 (10)	6 (12)	11 (11)	**0.749
	No	45 (90)	44 (88)	89 (89)	
Number of required surgeries	1	42 (84)	37 (74)	79 (79)	**0.389
	2	6 (12)	8 (16)	14 (14)	
	3	2 (4)	5 (10)	7 (7)	

The data are given as a number (n), percentage (%), and mean±standard deviation (SD)
* Mann-Whitney test; ** Chi-square test

5. Discussion

This study compares the results of the reconstruction of facial skin defects using skin flap and graft in Imam Reza Hospital, Birjand, Iran, in 2019-2020. The results showed that the relative frequency of esthetic complications in patients operated by the flap technique was significantly lower than that in those managed by the graft technique. Most of the studies have shown similar results. The studies of Lee et al. (9) and Rustemeyer et al. (17) showed fewer complications of the flap surgery technique, which was consistent with the results of our study. Ebrahimi et al. (16) compared local flaps and skin grafts to reconstruct cheek skin defects. Their results showed that patient satisfaction, color, and texture harmony in the flap group two weeks after surgery were significantly higher than those in the graft group. Our result and its similarity with other studies are probably because the flap technique is prepared from the skin adjacent to the lesion area; therefore, in terms of appearance, skin color, and texture, it is more similar to the lesion area. In terms of aesthetics, using skin flap is more acceptable and has fewer side effects than skin graft. However, in the study of Sapthavee et al. (18), the esthetic results after surgery with flap and skin grafting techniques were not significantly different. The discrepancy between the results of this study and our study can be because in the study conducted by Sapthavee et al. (18), only the reconstruction of nasal defects was evaluated, and the skin graft was often removed from the preauricular region. This area is more harmonious with the face in terms of color, thickness, and texture, and its graft results in better aesthetic results (19, 20). In the study conducted by Sapthavee et al. (18), the mean follow-up duration of patients was 13 months in the flap group and 19 months in the graft group. Since wound healing depends on time, this difference in follow-up duration can affect the results. The results of Ebrahimi et al. (16) showed that after 12 months of reconstructive surgery, the patient's tissue coordination did not differ significantly. The difference in the follow-up duration of patients between our study (3 months) and Ebrahimi's study can be the cause of this discrepancy.

The results of our study showed that the frequency of functional complications was not significantly related to the surgical method. These results differed from the study conducted by Igde et al. (21) and Mamsen et al. (22). These studies showed that the functional complications of flap surgery were more than flap surgery. Probably the reason for this difference is that the functional complications differ depending on the anatomical facial region. In cases that lead to functional impairment, such as tumoral lesions of the lip or eyelid area where all layers of soft tissue are involved, the surgeon cannot use a graft and must use a flap for repair, which can affect

the results of the study.

The results of our study showed that the recurrence of tumoral lesions had no significant relationship with the surgical technique performed. Removing the safe margin of healthy tissue in the excision of tumoral lesions prevents remaining malignancy and decreases the risk of recurrence. Kondo et al. (23) also found in their study that the recurrence of the lesion has no significant relationship with the surgical technique, which was consistent with the findings of our study.

The present study showed no significant difference between the two groups of flap and graft in the number of surgical procedures. Since the number of surgeries performed is affected by several factors, including the type of lesion, size of the lesion, and the margin involved in malignant lesions, comparing this relationship probably requires more comprehensive studies.

We found that the location of the lesion had a significant relationship with the type of surgery. In the areas of the forehead and scalp, zygoma, and temporal and around the ear, the reconstruction of lesions by graft surgery was significantly more than flap. In the areas of the cheek (buccal), nose, around the eyes and eyelids, and the jowl and lips, the reconstruction of lesions by flap surgery has been significantly more. In our patients, the size of the skin lesions in the forehead, scalp, zygoma, as well as temporal and ear areas, is broader and more skin is needed for reconstruction, and it is easier and more practical to use the graft in these situations. On the other hand, in the areas of the nose and around the eyes, buccal and lips, considering that these areas are smaller and more important in terms of function and beauty, it will be more logical to use a flap due to maintaining beauty and function. In this context, the results of this study were consistent with the results of a study conducted by Zelken et al. (24) in Taiwan. In their study, the flap technique in the nose and lip areas has been superior to other reconstruction methods.

Our study had some limitations. Not distinguishing the type of lesion (tumoral and traumatic) in our study may lead to bias and reduce the generalizability of the study. Therefore, it is suggested to carry out similar studies with more significant and homogenized populations regarding age, gender, and type of lesion. Another limitation of the study was the small number of patients who received grafts in Birjand (which led to the prolongation of the study) and the non-cooperation of patients for long-term follow-up.

6. Conclusion

In general, in the reconstruction of facial skin defects, the use of the skin flap will have better results than a skin graft from an aesthetic point of view. Among the advantages of using the graft, it can be mentioned that it is preferred in large defects. Our study confirms the results of previous studies. Therefore, it is suggested that in cases where it is possible to use both methods, the flap technique should be given priority.

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Footnotes

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