

# Comparison of local flaps versus skin grafts as reconstruction methods for defects in the medial canthal region

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**Background:** The medial canthal region features a complex three-dimensional and internal anatomical structure. When reconstructing a defect in this area, it is crucial to consider both functional and aesthetic aspects, which presents significant challenges. Generally, local flaps are preferred for reconstruction; however, skin grafts can be used when local flaps are not feasible. Therefore, we conducted a comparative analysis of surgical outcomes skin grafts when local flaps were not feasible, to determine which surgical method is more effective for medial canthal region reconstruction.

**Methods:** Twenty-five patients who underwent medial canthal region reconstruction using skin grafts or local flaps from 2002 to 2021 were enrolled. Patient information was obtained from medical records. Five plastic surgeons evaluated the surgical outcomes based on general appearance, color, contour, and symmetry.

**Results:** Skin grafts were used in eight patients and local flaps were used in 13. Combined reconstructions were employed in four cases. Minor complications arose in four cases but improved with conservative treatment. No major complications were reported. Recurrence of the skin cancer was noted in two cases. All categories showed higher scores for the local flap compared to both skin graft and combined reconstruction; however, the differences were not statistically significant respectively.

**Conclusion:** The choice of appropriate surgical methods for reconstructing defects in the medial canthal region depends on various factors, including the patient's overall health, the size and depth of the defect, and the degree of involvement of surrounding structures. When a local flap is not feasible, a skin graft may provide favorable surgical outcomes. Therefore, a skin graft can serve as a viable alternative for reconstructing the medial canthal region.

**Abbreviations:** BCC, basal cell carcinoma; IQR, interquartile range; MMS, Mohs micrographic surgery

**Keywords:** Plastic surgery procedures / Skin neoplasms / Skin transplantation / Surgical flaps

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## INTRODUCTION

The medial canthal region, located adjacent to the eyelid, cheek, and nose, features a complex three-dimensional structure with various internal components [1,2]. It is also a common site for malignant skin tumors, especially basal cell carcinoma (BCC) [3]. Defects from tumor resection may be confined to the medial canthal region but can extend to the upper and lower eyelids, nasal sidewall, dorsum, cheek, and deeper tissues, potentially involving the periosteum, lacrimal system, and medial

canthal ligament. Consequently, reconstructing defects in this area poses a significant challenge for surgeons, who must carefully consider both functional and aesthetic factors [2,4,5].

When reconstructing defects in the medial canthal region, it is crucial to consider the size and depth of the defect, as well as its unique three-dimensional structure and internal components. Additionally, the patient's age, characteristics, overall health, and systemic conditions should be considered when selecting the most appropriate method [2-5]. Reconstructive options include skin grafts, local flaps, and free flaps. Local flaps, which utilize adjacent tissues, are often preferred for reconstructing defects in the medial canthal region due to their superior color match and continuity of skin texture [1,6-9]. Although skin grafts can be employed for reconstruction in cases where local flap or free flap procedures are not feasible—due to factors such as a shortage of adjacent tissue or patient's surgical burden [4]—they may pose challenges, including color mismatches between the donor site and surrounding skin, as well as postoperative contracture [10].

Therefore, in this study, we compared and analyzed the surgical outcomes of medial canthal region defect reconstruction using skin grafts when local flaps were not feasible. Through this comparison, our goal was to determine which method is more effective for reconstructing the medial canthal region.

## METHODS

### Patients and methods

The study included patients who underwent Mohs micrographic surgery (MMS) for skin cancer in the medial canthal region and received subsequent reconstruction using a skin graft and/or local flap at a single institution from May 2002 to April 2021. To directly compare the surgical outcomes of skin grafts and local flaps, and to evaluate the efficacy of skin grafts as a complement to local flaps, patients were categorized as follows: patients reconstructed with a skin graft were categorized as group 1, those reconstructed with a local flap as group 2, and those who underwent combined reconstruction as group 3. The indications for using skin grafts and local flaps for reconstructing the medial canthal region were as follows: skin grafts were appropriate when the eyelid margin was intact, the defect was superficial or did not involve the muscle layer, and there was no bone exposure. They were also used when a local flap was not feasible due to insufficient adjacent tissue, extensive defects, or when the surgical burden on the patient was significant. Local flaps were indicated when the eyelid margin was involved, the defect included the muscle layer resulting in a muscle defect, or there was bone exposure. When coverage with a

local flap alone was insufficient, a combined reconstruction with a skin graft and local flap was performed. Medical records were reviewed to collect data on patients' age, sex, skin cancer causing the defect, recurrence status, surgical methods used for reconstruction, and patient dissatisfaction after surgery. Major postoperative complications including flap loss, necrosis, and skin graft loss, and minor complications, such as infection and inflammation, were analyzed through medical records reviews.

For the analysis of surgical outcomes, a retrospective review was conducted using preoperative and postoperative photographs of all patients. These photographs were reviewed by five board-certified plastic surgeons. Only postoperative photographs taken at least 6 months after surgery were used for the evaluation. The evaluation criteria included general appearance, color match, contour, and symmetry, each assessed on a 5-point scale (1 = bad, 2 = poor, 3 = fair, 4 = good, and 5 = excellent). Based on these evaluations, comparisons were made between the skin graft and local flap groups, as well as among all three groups, including those who underwent combined reconstruction.

### Statistical analysis

For the comparison between two independent groups regarding continuous variables, the median and interquartile range (IQR) were reported based on the normality of the data. The Wilcoxon rank sum test was applied to continuous variables when the assumption of normality was met. When comparing three independent groups for continuous variables, the median and IQR were again provided based on data normality. The Kruskal-Wallis test was utilized for this three-group comparison of continuous variables, contingent upon the fulfillment of the normality assumption. Normality was evaluated using histograms, skewness, kurtosis, and the Shapiro-Wilk test. All statistical tests were two-tailed, with *p*-values less than 0.05 deemed statistically significant. Data analysis was conducted using R software version 4.2.2 (R Foundation for Statistical Computing, <http://cran.r-project.org>).

## RESULTS

A total of 25 patients were included in the study, with a mean age of 60.4 years (range, 43–87 years). This study included nine men and 16 women. The skin cancer causing defects in the medial canthal region were BCC in 24 patients and dermatofibrosarcoma protuberans in one patient. Recurrence of the skin cancers occurred in two cases. Based on the surgical techniques used for reconstruction after MMS, eight patients were in group 1 (skin graft), 13 in group 2 (local flap), and four in group 3 (skin graft and local flap). No major complications such as flap

loss, necrosis or skin graft loss occurred. However, minor complications, including infection and inflammation, were observed in four patients, all of whom improved with conservative treatment involving dressings and antibiotics. Ten patients expressed dissatisfaction with the outcomes, citing issues such as bulky flaps, contracture, epiphora, and lagophthalmos. Of these, epiphora was the most frequently reported complaint (Tables 1, 2).

Based on retrospective photograph review, comparisons were conducted among the groups. Initially, a comparison between group 1 and group 2 was conducted. In the comparison between groups 1 and 2, group 2 scored higher in all four criteria: general appearance (median, 3.8; IQR, 3.6–4.2), color match (median, 4.2; IQR, 4.0–4.4), contour (median, 3.8; IQR, 3.6–4.0), and symmetry (median, 3.8; IQR, 3.2–4.2). In contrast, group 1's scores were lower: general appearance (median, 3.4; IQR, 3.0–3.9), color match (median, 3.6; IQR, 3.0–4.2), contour (median, 3.0; IQR, 2.8–3.7), and symmetry (median, 3.6; IQR 3.3–4.1). However, there were no statistically significant differences ( $p > 0.05$ ) (Table 3). Subsequently, comparisons among three groups, group 1, group 2, and group 3, were conducted. Group 3 showed scores for general appearance (median, 3.4; IQR, 2.9–3.7), color match (median, 3.7; IQR, 3.6–4.0), contour (median, 3.3; IQR, 2.6–3.9), and symmetry (median, 3.2; IQR, 2.5–3.7). Compared to group 1, group 3 showed higher scores in color match and contour, but slightly lower scores in symmetry. Group 2 showed higher scores in all categories compared to

group 3. Nevertheless, there were no statistically significant differences among the three groups ( $p > 0.05$ ) (Table 4).

## DISCUSSION

The reconstruction of defects in the medial canthal region presents significant challenges due to its complex three-dimensional structure and its proximity to adjacent structures such as the eyelid, cheek, and nose [4]. The authors noted that despite these complex structural characteristics, using skin grafts for reconstruction of superficial defects in the medial canthal region still yielded favorable surgical outcomes. This was attributed to the relatively thin skin in the medial canthal region, which likely results in fewer side effects from skin graft. We also noted that combining skin grafts with local flaps to reconstruct defects insufficiently covered by local flaps alone yielded favorable surgical outcomes comparable to those achieved with local flap alone. Therefore, we compared and analyzed the surgical outcomes of skin grafts versus local flaps, including cases where combined reconstruction were employed, to determine the most effective method for reconstructing the medial canthal region and to assess the viability of skin grafts as an option.

Initially, a comparison between group 1 and group 2 was conducted to directly compare the surgical outcomes of local flaps and skin grafts in the reconstruction of the medial canthal region. Upon reviewing the surgical outcomes evaluated by five plastic surgeons, no statistically significant difference was observed between groups 1 and 2. Both groups achieved generally high scores, around 3 points on a scale of 1 to 5, indicating that skin graft and local flap are effective for reconstructing the medial canthal region. These findings support the premise of this study, which posits that skin grafts can achieve results comparable to those of local flaps.

Additionally, the surgical outcomes of cases where skin grafts were combined with local flaps due to insufficient coverage of the defect with local flaps alone were compared to those of group 1 and group 2. This was done to evaluate the efficacy of skin grafts as an adjunct to local flaps. Upon examining the results of the comparisons among the three groups, group 3 showed higher scores in color match and contour compared to group 1, utilizing combined reconstruction with both skin graft and local flap. Group 2 showed higher scores in all categories compared to group 3 as well. However, statistically significant difference was not observed among the three groups in the comparative analysis. This suggests that favorable outcomes can be achieved when skin grafts are combined with local flap reconstruction, particularly in cases where local flaps alone are insufficient to adequately cover the defect. However, the validity of this claim depends

**Table 1.** Characteristics of patients

Category	Value
Age (yr), mean (range)	60.4 (43–87)
Sex	
Male	9
Female	16
Skin cancer	
Basal cell carcinoma	24
Dermatofibrosarcoma protuberans	1
Recurrence	2
Surgical methods	
Skin graft	8
Local flap	13
Combined reconstruction	4
Complications (n = 4)	
Major	0
Minor	4
Complaints (n = 10)	
Epiphora	4
Bulky flap	3
Contracture	2
Lagophthalmos	1

**Table 2.** Surgical methods

No.	Sex	Age (yr)	Defect size (mm)	Defect depth	Surgical method	Donor site
1	F	55	20 × 17	Subcutaneous layer	FTSG	Postauricular region
2	M	46	15 × 15	Subcutaneous layer	FTSG	Postauricular region
3	F	46	16 × 11	Subcutaneous layer	FTSG	Postauricular region
4	M	77	16 × 14	Subcutaneous layer	FTSG	Postauricular region
5	F	55	18 × 12	Muscle layer (superficial)	FTSG	Postauricular region
6	F	58	54 × 35	Muscle layer (superficial)	STSG	Thigh
7	F	53	15 × 15	Subcutaneous layer	FTSG	Postauricular region
8	M	53	25 × 20	Muscle layer (superficial)	STSG	Thigh
9	M	45	34 × 30	Muscle defect Bone exposure	Paramedian forehead flap	Forehead
10	M	64	56 × 10	Eyelid margin involved Muscle defect	Paramedian forehead flap	Forehead
11	F	63	15 × 10	Eyelid margin involved	Paramedian forehead flap	Forehead
12	F	78	25 × 20	Muscle defect	Paramedian forehead flap	Forehead
13	F	43	12 × 10	Muscle defect	Paramedian forehead flap	Forehead
14	F	67	13 × 13	Eyelid margin involved	OOMC flap	Upper & lower eyelid
15	F	68	15 × 15	Eyelid margin involved Muscle defect	OOMC flap	Upper & lower eyelid
16	M	62	45 × 25	Muscle defect Bone exposure	Paramedian forehead flap OOMC flap	Forehead Lower eyelid
17	M	62	43 × 30	Muscle defect Bone exposure	Paramedian forehead flap	Forehead
18	F	87	25 × 12	Eyelid margin involved Muscle defect	Paramedian forehead flap	Forehead
19	F	48	30 × 20	Eyelid margin involved Muscle defect Bone exposure	Paramedian forehead flap OOMC flap	Forehead Upper & lower eyelid
20	F	80	15 × 15	Eyelid margin involved	OOMC flap	Upper & lower eyelid
21	F	63	47 × 37	Eyelid margin involved Muscle defect Bone exposure	Paramedian forehead flap OOMC flap Nasolabial V-Y advancement flap	Forehead Upper & lower eyelid Nasolabial region
22	F	59	40 × 32	Eyelid margin involved Muscle defect	Paramedian forehead flap STSG	Forehead Upper eyelid
23	M	48	34 × 25	Eyelid margin involved Muscle defect	OOMC flap FTSG	Upper & lower eyelid Postauricular region
24	F	84	17 × 15	Eyelid margin involved Muscle defect	OOMC flap FTSG	Upper & lower eyelid Postauricular region
25	M	58	25 × 20	Eyelid margin involved Muscle defect	OOMC flap FTSG	Upper & lower eyelid Postauricular region

FTSG, full-thickness skin graft; STSG, split-thickness skin graft; OOMC flap, orbicularis oculi myocutaneous flap.

**Table 3.** Comparison of surgical outcomes between two groups

	Median (IQR)			p-value
	Overall (n = 21)	Group 1 (n = 8)	Group 2 (n = 13)	
General appearance	3.6 (3.2–4.2)	3.4 (3.0–3.9)	3.8 (3.6–4.2)	0.308
Color match	4.2 (3.8–4.2)	3.6 (3.0–4.2)	4.2 (4.0–4.4)	0.097
Contour	3.6 (3.2–4.0)	3.0 (2.8–3.7)	3.8 (3.6–4.0)	0.145
Symmetry	3.6 (3.2–4.2)	3.6 (3.3–4.1)	3.8 (3.2–4.2)	0.714

IQR, interquartile range; Group 1, skin graft; Group 2, local flap.  
Wilcoxon rank sum test for continuous variables.

on selecting patients according to appropriate indications.

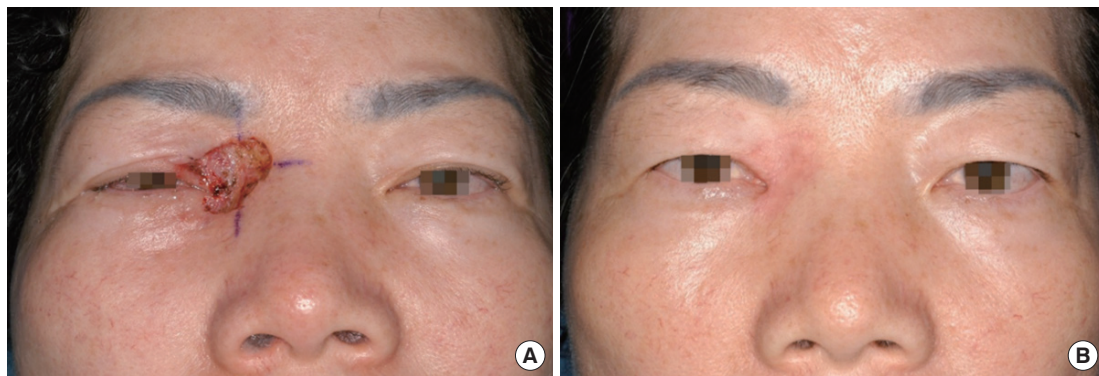
Individual case studies are presented below to provide further insights into the results. Case 1 involved a 55-year-old woman who underwent reconstruction with a full-thickness skin graft following MMS for BCC in the medial canthal region (Fig. 1). The defect after MMS extended to the medial canthal region and eyelid. Due to the superficial nature of the defect and an intact eyelid margin, a skin graft was employed, yielding favorable outcomes. Case 2 involved a 77-year-old man who underwent reconstruction with a full-thickness skin graft after MMS for

BCC in the medial canthal region (Fig. 2). Similar to case 1, the defect extended to the eyelid. However, the presence of an intact eyelid margin allowed reconstruction using a skin graft. Case 3 involved a 53-year-old man who underwent reconstruction with a thick split-thickness skin graft after MMS for BCC in the medial canthal region (Fig. 3). Although the defect was larger than in cases 1 and 2, the eyelid margin and muscle layer were intact, making it suitable for a skin graft. However, due to difficulty in harvesting skin from the postauricular region, a thick split-thickness skin graft was harvested from the thigh.

**Table 4.** Comparison of surgical outcomes among three groups

	Median (IQR)				p-value
	Overall (n=25)	Group 1 (n=8)	Group 2 (n=13)	Group 3 (n=4)	
General appearance	3.6 (3.2–4.2)	3.4 (0.0–3.9)	3.8 (3.6–4.2)	3.4 (2.9–3.7)	0.480
Color match	4.0 (3.6–4.2)	3.6 (3.0–4.2)	4.2 (4.0–4.4)	3.7 (3.6–4.0)	0.154
Contour	3.6 (3.0–4.0)	3.0 (2.8–3.7)	3.8 (3.6–4.0)	3.3 (2.6–3.9)	0.282
Symmetry	3.6 (3.0–4.2)	3.6 (3.3–4.1)	3.8 (3.2–4.2)	3.2 (2.5–3.7)	0.724

IQR, interquartile range; Group 1, skin graft; Group 2, local flap; Group 3, both method. Kruskal-Wallis test for continuous variable.



**Fig. 1.** Case 1. A 55-year-old woman underwent reconstruction with a full-thickness skin graft from the postauricular region following Mohs micrographic surgery (MMS) for basal cell carcinoma in the medial canthal region. The defect measured approximately 20×17 mm, spanning the medial canthal region, upper eyelid, lower eyelid, and nasal wall. The eyelid margin was intact, and the defect was confined to the superficial layer. The evaluation of surgical outcome yielded scores of 4.6 for general appearance, 4.2 for color match, 4.4 for contour, and 4.2 for symmetry. (A) Post-MMS photography. (B) Postoperative photography at a follow-up after 7 months.



**Fig. 2.** Case 2. A 77-year-old man underwent reconstruction using a full-thickness skin graft from the postauricular region after Mohs micrographic surgery (MMS) for a basal cell carcinoma in the medial canthal region. The defect size was approximately 16×14 mm, spanning the medial canthal region and upper eyelid. The eyelid margin was intact, and the defect was confined to the superficial layer. The evaluation of surgical outcomes yielded scores of 4.6 for general appearance, 4.6 for color match, 4.8 for contour, and 4.2 for symmetry. (A) Pre-MMS photography. (B) Post-MMS photography. (C) Postoperative photography at a follow-up after 52 months.

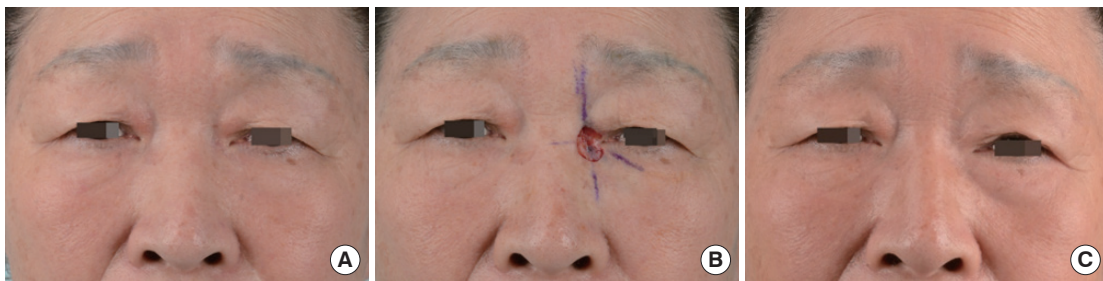
Due to differences in thigh skin color and thickness compared to the surrounding skin of the defect, there was a noticeable color mismatch and contour differences when compared to previous cases. Nevertheless, there were no complications, and the patient was generally satisfied. Cases 4 and 5 involved reconstruction with local flaps after MMS for BCC. In these cas-

es, the eyelid margin was not intact and the defect was deeper, making it unsuitable for skin graft application because of the potential for severe deformity. Local flaps were used for reconstruction in these cases and showed favorable surgical outcomes (Figs. 4, 5).

Some of those cases showed excellent results with skin grafts,



**Fig. 3.** Case 3. A 53-year-old man underwent reconstruction using a thick split-thickness skin graft from the thigh after Mohs micrographic surgery (MMS) for a basal cell carcinoma in the medial canthal region. The defect size was approximately 25×20 mm, extending across the medial canthal region, upper and lower eyelids, and even to the nasal wall and dorsum. While the eyelid margin was intact, a portion of the orbicularis oculi muscle was exposed. The defect was deeper, involving the removal of deep tissue layers. The evaluation of surgical outcomes yielded scores of 3.6 for general appearance, 2.2 for color match, 2.8 for contour, and 3.6 for symmetry. (A) Pre-MMS photography. (B) Post-MMS photography. (C) Postoperative photography at a follow-up after 25 months.



**Fig. 4.** Case 4. A 67-year-old woman underwent reconstruction using an orbicularis oculi myocutaneous V-Y advancement flap from the upper and lower eyelids after Mohs micrographic surgery (MMS) for a basal cell carcinoma in the medial canthal region. The defect size was approximately 13×13 mm, extending across the medial canthal region and upper and lower eyelids. A portion of the eyelid margin was compromised, and part of the orbicularis oculi muscle was exposed. The evaluation of surgical outcomes yielded scores of 4.2 for general appearance, 4.2 for color match, 4.0 for contour, and 4.0 for symmetry. (A) Pre-MMS photography. (B) Post-MMS photography. (C) Postoperative photography at a follow-up after 15 months.



**Fig. 5.** Case 5. A 62-year-old man underwent reconstruction using an orbicularis oculi myocutaneous V-Y advancement flap from the lower eyelid and a paramedian forehead flap after Mohs micrographic surgery (MMS) for a basal cell carcinoma in the medial canthal region. The defect size was approximately 45×25 mm, extending widely across the medial canthal region, cheek, nasal wall, and dorsum. The orbicularis oculi muscle was excised, exposing the orbital fat, and part of the nasal bone was also exposed. The evaluation of surgical outcomes yielded scores of 4.2 for general appearance, 4.0 for color match, 4.0 for contour, and 4.0 for symmetry. (A) Pre-MMS photography. (B) Post-MMS photography. (C) Postoperative photography at a follow-up after 45 months.

while others had somewhat disappointing outcomes. Generally, skin grafts are recognized to have a high potential for patch effect, which can arise from color mismatch, contour differences, and postoperative contracture between the skin graft and surrounding skin [8]. However, the surgical outcomes of this study indicate that not all cases involving skin grafting exhibited these issues. In cases 1 and 2, the results were excellent in terms of color, contour, and symmetry. Additionally, these patients recovered well without experiencing any significant side effects or discomfort. In case 3, although the typical patch effects of skin grafts were evident with color and contour differences, the overall appearance and symmetry were good, and the patient reported no discomfort. Even in situations where local flaps were challenging to use due to the defect's location in the medial canthal region or the patient's condition, skin grafting still yielded successful outcomes without significant side effects or patient discomfort.

Postoperative complications, including infection and inflammation, occurred in some cases but were resolved with conservative treatment. The most commonly reported postoperative discomfort by patients was epiphora. This issue may be attributed to the structural characteristics of the medial canthal region and the degree of tissue involvement during tumor resection, rather than to variations in surgical techniques. Therefore, it cannot be concluded that one surgical method results in significantly more complications than another.

Research on reconstructing the medial canthal region has been actively pursued in the past. However, few studies have directly compared skin grafts and local flaps for treating defects in this area. Our results, suggesting that skin grafts can yield excellent results in the reconstruction of the medial canthal region when the surgical method is appropriately chosen, are consistent with those of a previous study by Vogelin et al. [4]. This study's findings suggest that when the eyelid remains intact and the defect is superficial, confined to the subcutaneous layer, skin grafts can provide functionally and aesthetically satisfactory outcomes. Skin grafts have also proven successful in cases where patients were reluctant to undergo more complex surgical procedures. Additionally, through an analysis of cases utilizing split-thickness skin grafts, it was determined that both full-thickness and split-thickness skin grafts generally yield satisfactory outcomes when appropriate indications are met. Therefore, in reconstructing the medial canthal region, the choice of method should consider the patient's condition and the defect's characteristics, such as depth, size, and its relationship with surrounding structures. Skin grafts are a viable option when appropriate [4-11]. The absence of significant differences in the statistical analysis of surgical outcomes between the two meth-

ods supports this assertion, suggesting that it could serve as a basis for a more proactive selection of skin grafts in medial canthal region reconstruction. However, minimizing complications through proper donor site selection, correct surgical techniques, and diligent postoperative care is crucial [12,13].

The major limitation of this study is the small number of patients in each group. Further research involving larger patient cohorts and extended follow-up periods could provide more robust evidence that supports the use of skin grafts as a viable option for reconstructing the medial canthal region.

In conclusion, the reconstruction of the medial canthal region presents considerable challenges due to its unique anatomical features and its proximity to surrounding structures. This study demonstrates that when the patient's individual characteristics, overall health status, and the specific characteristics of the defect are thoroughly evaluated, skin grafts can be a viable option for reconstructing this area. Furthermore, the findings suggest that skin grafts could be more widely used in the reconstruction of the medial canthal region, and further research could strengthen this recommendation.

## NOTES

### Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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### Ethical approval

This study was approved by the Institutional Review Board of Pusan National University Hospital (IRB No. 2402-026-136) and was performed in accordance with the principles of the Declaration of Helsinki.

### Patient consent

The patients provided written informed consent for publication and use of their images.

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Lee. Formal analysis: Min Hak Lee. Funding acquisition: Yong Chan Bae. Methodology: Min Hak Lee. Project administration: Yong Chan Bae. Visualization: Min Hak Lee. Writing - original draft: Min Hak Lee. Writing - review & editing: Hoon Soo Kim, Yong Chan Bae. Investigation: Min Hak Lee. Resources: Yong Chan Bae. Software: Min Hak Lee. Supervision: Yong Chan Bae. Validation: Yong Chan Bae.

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