

화상 후 이개부 결손의 재건

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Reconstruction of Post Burn Auricular Defect

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Purpose: Patients with serious burns are prone to chondritis due to lack of soft tissue in the auricle, which can cause severe defects in the auricular morphology. In addition, skin damage occurs frequently in the vicinity of post-burn wounds, presenting difficulties in reconstruction surgery. An auricular reconstruction has functional and cosmetic significance. The aim of this study is to develop appropriate reconstruction methods for auricular defects.

Methods: Thirty seven patients, who were treated for auricular defects from 2005 to 2009, were enrolled in this study. A local flap, multiple regional flaps and cartilage framework with or without a temporal fascial flap were applied in reconstruction surgery according to the location of the auricular defect.

Results: The age of the subjects ranged from 11 to 56. Some subjects had defects that cover more than half of the helical rim with most exhibiting post-burn scars in the vicinity, for whom a multiple regional flap was used. A single use of a tubed flap was sufficient for subjects with defects that covered less than half of the helical rim. A regional flap was also used for reconstruction in subjects with defects covering both the helical rim and antehelix.

Conclusion: Achieving satisfactory results from the skin flaps and skin grafts for post-burn auricular defects in both functional and cosmetic aspects is a difficult task.

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Therefore, selecting an appropriate surgical method through proper diagnosis of the auricular defect and the state of the available skin in the vicinity is essential.

Key Words: Auricular reconstruction, Post burn auricular defect

I. INTRODUCTION

Anatomically, the ear is the most prominent facial feature and is particularly vulnerable to facial trauma. It is also very important in cosmetic and functional terms. Auricular defects can be resulted from direct traumatic injuries or subsequent chondritis.¹ Furthermore, because the auricle contains almost no soft tissues, facial burns and trauma readily cause chondritis and damage to the surrounding tissues.² For plastic surgeons, an auricular reconstruction requires significant level of skill.³ Over the past 20 years, substantial effort has been made to develop auricular reconstruction methods, and various means of classifying auricular defects have been introduced.⁴ In particular, K'ung et al classified the post-burn auricular defects into the following three categories⁵

- a. Mild type, in which there is a loss of the helix and the upper part of the auricle without extensive scarring.
- b. Moderate type, in which the concha is normal, even though it may be adherent to the side of the head; the upper half of the ear is sloughed with a loss of the antehelix altogether with its anterior and posterior crura.
- c. Severe type with only a remnant of the concha and marked scarring of the local soft tissue; the external auditory meatus is normal or it may be stenosed.

In this study, a different approach was used due to a difficulty of correction with this classification.

Over the last 5 years, our clinic classified auricular reconstruction surgical methods according to the area of the defective region and its vicinity. Satisfactory results were obtained in both cosmetic and functional aspects. This paper reports the results along with case reports and

literature reviews.

- a. Local flap.
- b. Multiple local flaps and regional flaps.
- c. Temporal fascial flap with or without a cartilage framework.

II. MATERIALS AND METHODS

Thirty seven cases of reconstruction surgery performed from 2005 to 2009 on patients with auricular defects were examined. Each case was classified according to the

surgical method used. With the patients' consent, out-patient pictures were taken before and after the surgery. The length of the follow-up period was approximately 11 months.

III. RESULTS

Among the 37 patients, 30 were male and 7 were female, showing a male to female ratio of 4.3 : 1. The age of the subjects ranged from 11 to 56 with an average age of 34 (Table I). Various types of flaps and grafts were

Table I. Patients' Profile

Case	Sex /Age	Defect location	Surrounding tissue	Surgical method	Score	No.op	Complication
1	M / 13	U-1	I	LF	3	1	
2	M / 29	U-2-A	S	LF & SG	2	1	
3	M / 36	L	I	LF	3	1	
4	M / 19	UM-2-A	S	TF	4	2	
5	M / 30	U-1	s	LF	3	1	
6	M / 31	U-1	I	LF	4	1	
7	M / 41	U-1	S	LF	1	1	
8	M / 56	U-1	I	TF	4	2	
9	M / 39	UM-2-A(Lt)	S	LF & PA	4	1	
10	M / 39	U-2-A(Rt)	S	TFF & PA	2	4	Total loss
11	M / 36	U-1	S	TF	3	2	
12	M / 36	ML-2	S	TF	3	2	
13	F / 12	UM-2	I	LF & SG	4	1	
14	M / 27	U-1	I	TF	4	2	
15	M / 35	T	S	CF & TFF	3	2	
16	M / 37	U-1	S	TF	3	2	
17	M / 54	L	I	LF	3	1	
18	M / 52	UM-2-A	S	TF	4	4	
19	M / 21	U-1-A	I	TF	3	1	
20	M / 55	T	S	TFF	2	3	Infection
21	M / 23	UM-2-A	S	TF & PA	3	3	
22	M / 19	U-1	S	PA	4	2	
23	F / 29	L	I	LF	3	1	
24	M / 27	L-1	I	LF	3	1	
25	M / 37	UM-2-A	S	LF	3	2	
26	F / 49	U-1	I	TF	4	2	
27	F / 11	U-1	S	LF & SG	3	2	
28	M / 40	T	S	TFF	2	2	
29	M / 28	U-2-A	S	TFF	4	1	
30	M / 46	T	I	PA & SG	4	3	
31	F / 42	L	S	LF	3	1	
32	M / 24	U-1-A	S	PA	3	2	
33	M / 37	U-1	I	TF	4	2	
34	M / 37	U-2	I	LF & TF	3	3	
35	F / 32	UM-2-A	I	TF & PA	3	3	
36	M / 29	T	S	CF & SG	3	2	
37	F / 49	UM-2-A	S	PA	1	1	

U, upper pole; M, middle pole; L, lobe; T, total; A, antehelix; 1, size under 1/2; 2, size over 1/2; I, intact; S, scarring; LF, local flap; SG, skin graft; PA, posterior auricular flap; TFF, temporal fascial flap; TF, tubed flap; CF, cartilage frame work.

used for the reconstruction in accordance with the area of the defective region. Five cases showed total ear loss, in which temporal fascial flaps were mainly used. More than half of the helical rim was defective in 13 cases, among which 12 cases exhibited post-burn scars in the vicinity of the defect. Fourteen cases showed defects that covered less than half of the helical rim. Of these, 10 cases had tissues with a post-burn scar in the vicinity of the defect. For a reconstruction in these cases, the single use of a regional flap particularly the tubed flap was sufficient. The defect covered both the helical rim and antehelix in 12 cases. All of these cases had scars in the vicinity of the defective regions, and were reconstructed using multiple regional flaps concomitantly with a temporal fascial flap. Five cases exhibited ear lobe defects, which was treated with a local flap and skin graft. The results of auricular reconstruction were evaluated using a 4-point scar scale.⁶ Cases in which a multiple regional flap or local flap had been used showed high scores of

3 to 4 points (Table I, II).

Case 1

A 43-year-old male patient had defects in more than half of the upper, middle and lower helical rim of the right ear due to flame burns, accompanied by defects in the antehelix. Although post-burn scars were present in the vicinity of the defective region, a regional flap was created for the reconstruction using the skin surrounding the defect. Defects in the root area of the upper pole and rim were reconstructed using a posterior auricular flap and multiple local flap. Reconstruction surgery was successful and the patient's level of satisfaction was high (Fig. 1).

Case 2

A 52-year-old male patient sustained defects in the antehelix and the upper and middle parts of the right ear due to a flame burn. All the surrounding tissues were damaged, rendering tubed and posterior auricular methods impossible. The reconstruction was performed using a temporal fascial flap. The upper and middle part rim and the antehelix were reconstructed adequately. The shape of the scapha was observed after reconstruction of the antehelix (Fig. 2).

Case 3

A 43-year-old male patient had defects in the antehelix as well as upper, middle, and lower parts of the ear as a result of a flame burn. The surrounding skin tissues were intact. An auricular reconstruction was performed using temporal fascial flap with the cartilage frame work. Subsequently, the color of the reconstructed structure was made similar to the skin color using dermabrasion and a dermal overgraft (Fig. 3).

Case 4

A 39-year-old male patient had defects in the upper pole helical rim and antehelix. The scapha on the ear was caused by a flame burn. Scars are apparent in the surrounding

Table II. Four-point Scale of the Outcome

Clinical assessment after ear reconstruction	Grade	Score
Symmetry-satis	Excellent	4
Details-all satis		
Symmetry-satis	Good	3
Details-any one unsatis		
Symmetry-unsatis	Fair	2
Details-all satis		
Symmetry-unsatis	Poor	1
Details-any one unsatis		



Fig. 1. Case 1. In order from left to right: preoperative, intraoperative, and postoperative views of the defect. (Left) Defects are present in more than half of the upper, middle, and lower helical rim of the right ear, accompanied by defects in the antehelix. (Center, left, right) Intraoperative figure showing the corrective procedure for the defects in the root area of the upper pole and rim, using a posterior auricular flap and multiple local flap. (Right) 6 months after the treatment, the initial defects in the rim and the antehelix, as well as the deformity in the scapha were reconstructed substantially.

tissues, though not to the degree that the tissues cannot be used. The auricular structure was reconstructed using a

transpositional flap and tubed flap. The upper rim, antehelix and scapha were reconstructed satisfactorily (Fig. 4).

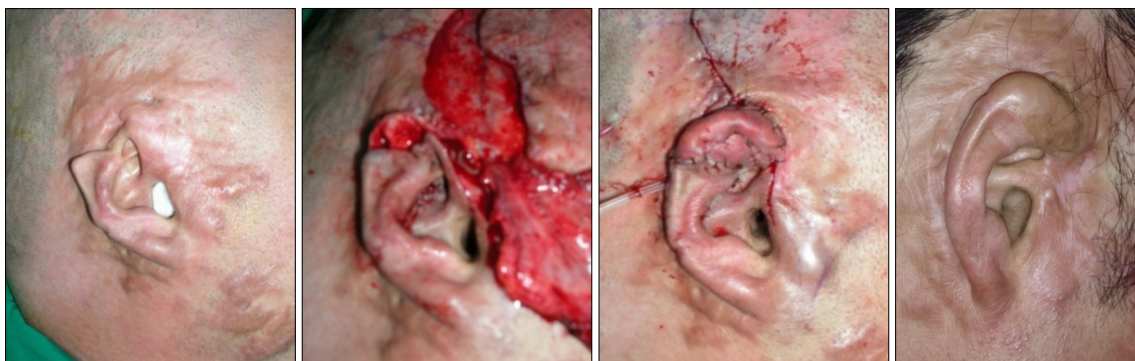


Fig. 2. Case 2. In order from left to right: preoperative, intraoperative (Center, left, right) and postoperative (Right) views of the defect. (Left) Preoperative view of the defect covering the upper and middle part helical rim and the antehelix, with scars apparent in the surrounding tissues. (Center, left, right) Reconstruction of the surrounding scars and antehelix was attempted using a temporal fascial flap. (Right) The upper and middle part rim and antehelix was reconstructed adequately. The shape of the scapha after the reconstruction of antehelix can be seen.



Fig. 3. Case 3. In order from left to right: preoperative, intraoperative, and postoperative views of the defect (Center, right and Right). (Left) Deformities in the upper, middle, and parts of lower auricular regions, as well as in the antehelix. Scars are apparent in the surrounding tissues. (Center, left) The auricular structure was reconstructed using a temporal fascial flap. (Center, right and Right) Subsequently, the color of the reconstructed auricles was restored to normal skin color using dermabrasion and a dermal overgraft.



Fig. 4. Case 4. In order from left to right: preoperative, intraoperative, and postoperative views of the defect. (Left) Deformities in the upper pole and antehelix with scapha. Scars are apparent in the surrounding tissues, though not to the degree that the tissues cannot be used. (Center) The auricular structure was reconstructed using a transpositional flap and tubed flap. (Right) The upper rim, antehelix and scapha were reconstructed adequately.

IV. DISCUSSION

According to Bhandari, 90% of patients with facial burns also suffer burns in the auricles. Thirty percent of these patients acquire chondritis as a serious complication,⁷ which leads to deformation of the auricles. This complication can be minimized by observing the following methods. Pressure applied to a burned ear must be minimized, and overly bulky dressings must be avoided. In addition, eschar and crust must not be overly debrided and should be minimized. The wound must be dressed twice a day along with the administration of topical antibiotics.⁸ In most cases of facial burns, the tissues surrounding the burn are severely damaged. Therefore, they are unsuitable for use in reconstruction surgery. Even when they are used, results tend to be unsatisfactory due to the poor circulation. It is difficult to reconstruct an auricle defect, and the following three points require particular focus: the provision of adequate blood supply; a well-maintained framework; and appropriate use of poor skin.⁹ A temporal fascial flap was used to solve this problem, and rib cartilage was used as the framework in cases of total auricular loss. However cases with partial defects did not undergo major operations. The reconstruction was performed easily using a multiple regional flap. A tubed flap was used to obtain satisfactory results in cases where the defects covered less than a half of the helical rim and were limited to the upper or lower parts of the ear. In particular, the use of a posterior auricular flap could produce good results in cases where the defect was located at the upper pole. In addition, a reconstruction through using a tubed flap is recommended if the scars in the vicinity of the defect are not severe. Another paper utilized a temporal fascial flap for a reconstruction of the upper pole of the auricle. However, a multiple regional flap is more useful if the vicinity is suitable for a regional flap. When designing a tubed flap, it is particularly important to take contracture into consideration and make the flap approximately 0.5 cm longer.

In most cases, where the defect covered more than half of the helical rim, there is a high likelihood that the scars would be prevalent in the vicinity. To achieve a satisfactory reconstruction for these cases, a tubed flap had to be used twice, or multiple flaps were necessary. In cases where the defect covers antehelix and the surrounding tissues are intact, simultaneous correction of antehelix using a posterior auricular flap and the

helical rim using a tubed flap produces more satisfactory results. In cases where damage in the antehelix is accompanied by defects in the scapha, corrective measures using a transpositional flap and posterior auricular flap produced good results.

The use of a temporal fascial flap for a reconstruction reduced the number of procedures and produced adequate results in cases where the surrounding tissues were scarred too severely and the size of the defect was large. A temporal fascial flap is quite versatile and useful in cases where the surrounding skin is excessively scarred and cannot be treated using local flaps. A reconstruction of ear lobe defects was attempted using a local flap. Securing an adequate framework is essential in cases of total ear loss. A study carried out by Wellisz confirmed that use of implants for a reconstruction enables rapid vascularization and endows stronger resistance to infections.¹⁰ However, in this study, autogenous cartilage was applied in reconstruction surgery and is believed to produce better results in young patients.

V. CONCLUSION

Achieving satisfactory results from skin flaps and skin grafts for post-burn auricular defects in both functional and cosmetic aspects is a difficult task. However, this can be achieved through the proper utilization of a multiple local flap and temporal fascial flap, as was done at our department. Therefore, the selection of an appropriate surgical method requires a proper diagnosis of the auricular defect and the state of the available skin in the vicinity.

REFERENCES

1. Mills DC 2nd, Roberts LW, Mason AD Jr, McManus WF, Pruitt BA Jr: Suppurative chondritis: its incidence, prevention, and treatment in burn patients. *Plast Reconstr Surg* 82: 267, 1988
2. Chang KN, DeArmond SJ, Bunkle HJ Jr: Sensory reinnervation in microsurgical reconstruction of the heel. *Plast Reconstr Surg* 78: 652, 1986
3. Ibrahim SM, Salem IL: Burned ear: the use of a staged Nagata technique for ear reconstruction. *J Plast Reconstr Aesthet Surg* 61: 52, 2008
4. El-Khatib HA, Al-Basti HB, Al-Ghoul A, Al-Gaber H, Al-Hami T: Subtotal reconstruction of the burned auricle. *Burns* 31: 230, 2005
5. K'ung FH, Chu HY, Hao CJ: Experiences in the plastic repair of the burned ear. *Chin Med J* 38: 168, 1966.
6. Harris PA, Ladhani K, Das-Gupta R, Gault DT: Reconstruction of acquired sub-total ear defects with autologous costal

- cartilage. *Br J Plast Surg* 52: 268, 1999
7. Bhandari PS: Total ear reconstruction in post burn deformity. *Burns* 24: 661, 1998
 8. Purdue GF, Hunt JL: Chondritis of the burned ear, a preventable complication. *Am J Surg* 152: 257, 1986
 9. Yamada A, Imai K, Nomachi T, Fujimoto T, Morimoto K: Total reconstruction of the burned auricle. *Burns* 33: 112, 2007
 10. Wellisz T: The ear model: an aid for total ear reconstruction. *Plast Reconstr Surg* 82: 1079, 1988