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Cosmetic outcome of implantation of cross-linked human acellular dermal matrix after parotidectomy

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Abstract

Although skin depression after parotidectomy affects the patient's satisfaction with cosmesis we know of little research about it, so we attempted to alleviate it by inserting human acellular dermal matrix (hADM) after the operation. We made a retrospective analysis of the casenotes of 63 patients who were diagnosed with parotid tumours and were operated on between January 2015 and December 2016. Factors that affect satisfaction with cosmesis, including the use of hADM, sex, age, incision, size of tumour, sample size, complications, and the name of the surgeon were recorded and evaluated on a scale from 1 (most unsatisfactory) to 10 (very satisfactory), and the satisfaction according to each factor was compared. The mean (SD) follow-up period was 13 (6) months, and 19 of the 63 patients developed complications. Satisfaction was significantly better when hADM had been inserted ($p = 0.0008$), when the patient was female ($p = 0.033$), or there were no complications $p = 0.0161$). On linear regression analysis, all three factors showed a significant causal relation with satisfactory cosmesis. Insertion of hADM after operations on the parotid gland seems to be effective in improving this by preventing skin depression.

Keywords: parotidectomy; acellular dermis; cosmetics; outcomes; complications

Introduction

Parotidectomy is a common technique for removing parotid tumours. However, it is also associated with complications such as paralysis of the facial nerve, visible facial scars, sensory abnormalities around the auricle, and gustatory sweating. In particular, dimpling of the skin is a major cosmetic issue associated with parotidectomy and visible facial scars.[1,2] The removal of the parotid gland often leaves a depression in the periauricular and retromandibular areas, causing apparent asymmetry. This is often a source of dissatisfaction, particularly in young people, and those being operated on for benign disease.[3,4] Several reconstructive options have been described, including those involving the sternocleidomastoid muscle, the superficial musculoaponeurotic system, an autologous dermal fat graft, and lyophilised dermis.[3–6] However, the effectiveness of reconstruction after parotidectomy is controversial because complications include liquefaction, seroma, sialocele, haematoma, and restricted cervical movement.

Human acellular dermal matrix (hADM) contains collagen, elastin, proteoglycans, laminin, and basement membrane, and is cross-linked by electron beam irradiation. It acts as a biological scaffold for re-epithelialisation, neovascularisation, and infiltration of fibroblasts, but it does not induce an immune response.[7] It has been used to repair burn scars, and for reconstructive surgery such as breast reconstruction, abdominal hernia repair, and cleft palate repair.[8–11] It has also been used to prevent Frey syndrome

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and facial deformity after parotidectomy.[12–15] There is evidence that AlloDerm™ (LifeCell) reduces the incidence of Frey syndrome effectively and safely,[12,13] but it is not clear whether AlloDerm™ implants will improve the facial contour.[12]

The purpose of this study was to investigate the cosmetic effects of insertion of hADM after parotidectomy.

Patients and methods

Sixty-three patients who were treated by parotidectomy between January 2015 and December 2016 were enrolled in the study, and we retrospectively reviewed their casenotes and recorded age, sex, type of parotidectomy, neck dissection, size of specimen, size of tumour, skin incision, whether hADM was inserted, operating surgeon, and complications.Whether hADM should be inserted was decided arbitrarily at the time and was not randomised. We used MegaDerm™ (Lncbio, Seoul) as the implantable hADM after parotidectomy. The study was approved by the Institutional Review Border of Gachon University Gil Medical Center (approval number; GAIRB2017-116).

Satisfaction with cosmesis was evaluated on a scale from 1 (most unsatisfactory) to 10 (very satisfactory) after a follow-up period of more than six months postoperatively. Patients who did not visit the hospital were followed-up by telephone and those who were diagnosed with malignancy or underwent neck dissection were excluded.

The type of parotidectomy was recorded from the records and photographs, and divided into partial, superficial, and total parotidectomy. The temporal and zygomatic branches of the facial nerve were defined as the upper division, and the marginal mandibular and the cervical branches as the lower division. Partial parotidectomy was defined as a procedure that exposed only one of the upper and lower divisions of the facial nerve; superficial parotidectomy as one that exposed both divisions of the facial nerve; and total parotidectomy as resection of both the superficial and deep lobe of the parotid gland.

The size of the sample was based on the longest diameter of the entire specimen as described in the postoperative histopathological report, and was divided into segments that were smaller than 4 cm and more than 4 cm. The size of the tumour was based on its longest diameter, and it was divided into small (<2 cm), medium (>2 cm but <4 cm), and large (≥ 4 cm).

The skin incision was classified as modified Blair or modified facelift.[12] Patients were divided into two groups – those who did, and those who did not, have hADM inserted.

We compared the cosmetic satisfaction between the two groups for sex, age, type of parotidectomy, size of the specimen, size of the tumour, complications, and operating surgeon.

Table 1
Statistical effect of attributable factors for aesthetic satisfaction after parotidectomy.

	No. (n = 63)	Mean (SD)	p value
Sex:			0.033*
Male	42	7.57 (2.67)	
Female	21	9.10 (1.48)	
Parotidectomy:			0.234
Partial	37	8.05 (2.30)	
Superficial	21	7.71 (2.87)	
Total	5	9.8 (0.45)	
Size of tumour (cm):			0.061
Small (≤2)	11	9.54 (0.82)	
Medium (>2, ≤4)	41	7.83 (2.50)	
Large (>4)	11	7.55 (2.95)	
Size of specimen (cm):			0.110
A (≤4)	26	8.69 (2.04)	
B (>4)	37	7.65 (2.65)	
Incision:			0.112
Blair	39	8.40 (2.43)	
Face-lift	24	7.63 (2.46)	
MegaDerm™:			0.0008*
Yes	23	9.22 (1.91)	
No	40	7.43 (2.51)	
Operator:			0.909
A	29	8.07 (2.81)	
B	34	8.15 (2.18)	
Complication:			
Yes	19	6.79 (2.97)	0.0161*
No	44	8.64 (1.93)	
Age-correlation:			
Pearson r (95% CI)	0.01266 (−0.2358 to 0.2596)		0.9216

* =p < 0.05 on Mann Whitney testing.

Statistical analysis

Statistics were analysed with the aid of Prism 6 software (GraphPad). We used the Mann Whitney test and the Kruskal-Wallis test to verify the difference in satisfaction with cosmesis for each factor. Pearson's correlation coefficient was used to evaluate the correlation between age and satisfaction. Multiple regression was used to evaluate the causality of the factors that had a significant effect on satisfaction, and the chi squared test to verify the significance of the difference in sex distribution for each factor. Probabilities of less than 0.05 were accepted as significant.

Results

Seventy-six patients underwent parotidectomy between January 2015 and December 2016, of whom 10 were excluded as they had cancer, and three because they were not assessable, leaving 63 patients to be included in the study. Operations were done by two head and neck specialists with more than 10 years' experience each. The mean (SD) follow-up period was 13 (6) months. Table 1 shows the comparability of the series, and indicates the significant variables. hADM was inserted in 23 patients (Fig. 1).

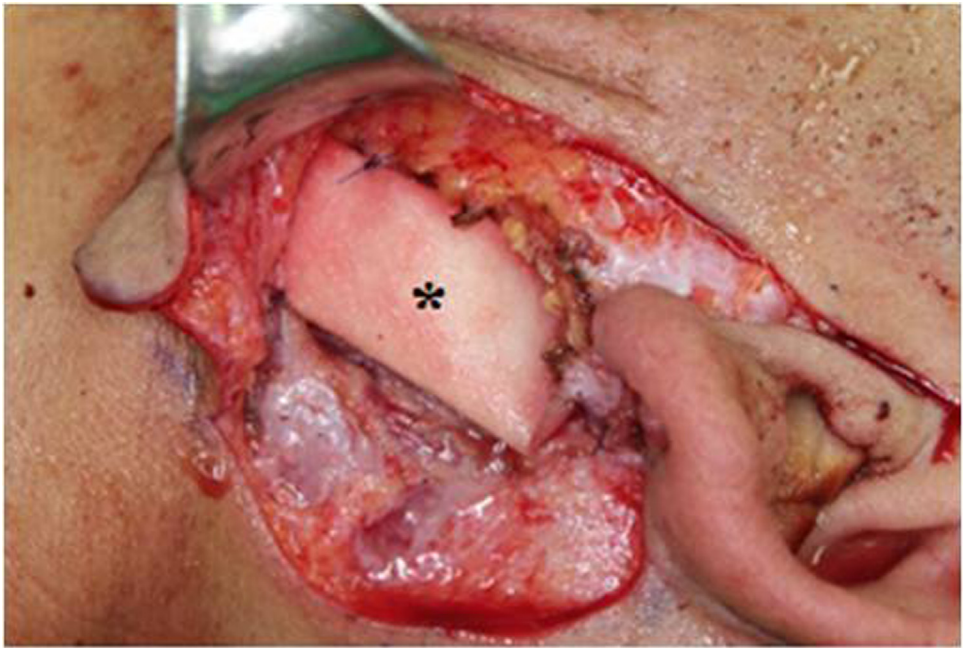

Fig. 1. Implantation of human acellular dermal matrix (asterisk) after left partial parotidectomy.

Table 2
Multiple regression for significant variables.

Factors	R^2	F	ß	*p*	95% CI of slope
Sex	0.5246	9.507	0.270	0.007*	0.3334 to 1.691
hADM	0.4874	11.04	0.318	0.0116*	0.2546 to 1.581
Complications	0.3220	5.224	−0.235	0.0431*	0.03802 to 2.014

hADM = human acellular dermal matrix.
* =p < 0.05 on multiple regression.

There was no significant difference in cosmetic satisfaction according to the size of tumour, size of the specimen, method of incision, operating surgeon, or age. Multiple regression analysis of the factors that did show significant differences is shown in Table 2.

To try and find out why satisfaction with cosmesis was worse in men, we analysed the difference of each factor according to sex (Table 3).

There were 24 complications among the 19 patients who developed postoperative complications including facial paralysis, sialocele, gustatory sweating, periauricular sensory abnormalities, and keloids. Periauricular sensory abnormalities were the most common (n = 10). There were no significant differences in the incidence of complications depending on whether hADM was used or not. However, 20 of the 24 occurred in patients who did not have hADM inserted (Table 4).

Table 3
Analysis for sex. Data are number of patients.

Factors	Male	Female	p value
Parotidectomy:			0.2394
Partial	24	13	
Superficial	13	8	
Total	5	0	
Small	7	4	
Size of tumour:			0.5023
Medium	26	15	
Large	9	2	
Size of specimen:			0.0038*
<4 cm	12	14	
≥4 cm	30	7	
Incision:			0.1302
Blair	29	10	
Face-lift	13	11	
MegaDerm™:			0.7113
Yes	16	7	
No	26	14	
Complication:			0.1742
Yes	15	4	
No	27	17	
Operator:			0.309
A	20	7	
B	22	14	

* =p < 0.05 by chi squared testing.

Discussion

The purpose of this study was to evaluate the cosmetic effects of insertion of hADM after parotidectomy, and to analyse factors that might have affected cosmesis. As a result, the use of hADM, sex, and the presence of complications each had a significant impact.

Previous publications have reported that covering the surgical site with a flap after operation on the parotid can help to prevent postoperative complications, including Frey syndrome, and may result in a better cosmetic outcome.[3,16] The musculoaponeurotic system or the sternocleidomastoid mus-

Table 4
Analysis of complications.

	hADM			p value
	Yes	No	Total	
Complications:				
Yes	4	15	19	
No	19	25	44	0.0941
Total	23	40	63	
Distribution of complications:				
Facial palsy	1	1	2	
Sialocele	0	1	1	
Frey syndrome	0	6	6	0.2593
Sensory deficit	3	7	10	
Keloid	0	5	5	
Total	4	20	24	

hADM = human acellular dermal matrix.

cle were used for the flap. hADM is also a useful material to use to cover the parotidectomy space. AlloDerm™ has been used to prevent Frey syndrome and replace defects in volume after parotidectomy.[12,13] In addition to AlloDerm™, other substitutes include J1- ADM™ (Beijing JayyaLife Biotissue Engineering Co. Ltd) and RENOV™ tissue sheets (Beijing Qing Yuan Wei Ye Bio-tisseu Engineering) have been used to replace the parotid defect.[14,15] MegaDerm™ (L&C BIO, Seongnam, Korea), which has recently been introduced as a sterile and non-immunogenic ADM, is made using electron-beam sterilisation to eliminate viruses, bacteria, and spores, and achieves a 10^{-6} level of sterility, while AlloDerm™ is an aseptic hADM.[17] Several studies have reported that MegaDerm™ was useful and comparable to AlloDerm™ for breast reconstruction. However, we know of no study that has evaluated the effect of MegaDerm™ in parotidectomy.[17,18]

MegaDerm™ has a rigid plate-like shape 50 mm × 60 mm × 1.4 mm in size. However, when wet it softens, folds, or turns, and is adjustable to the desired shape, so we could easily cover the cut surface during parotidectomy by using MegaDerm™ to replace the defect in volume. It may also support the skin flap with a certain amount of thickness and adequate volume. In addition, there was no significant difference in the development of postoperative complications between the hADM-insertion group and the non-insertion group. Frey syndrome developed in six patients in the non-insertion group and none in the insertion group, so the risk of using hADM is expected to be low.

The results showed that the sex of the patient affected postoperative cosmetic satisfaction. We expected that women's satisfaction would be less than that of men because they tend to be more concerned about their appearance. Interestingly, however, the results showed that women were more satisfied than men. When we analysed the factors in each group based on sex, we found that the size of the resected sample was larger in men than in women. In other words, the volume removed from men was larger than that from women, so skin depression is more prominent and cosmetic satisfaction less as a result. Ciuman et al[19] compared the outcomes after various types of parotid resection, and reported that the extent of parotidectomy was related to cosmetic outcome, sensory impairment, and Frey syndrome.

Postoperative complications also had a significant effect on satisfaction, and we recorded facial palsy, sialocele, sensory abnormality, gustatory sweating, and keloid. Although it is difficult to confirm whether these symptoms and signs are directly related to cosmesis, it is important to note that in patients who did not develop complications, cosmetic satisfaction was greater than among patients who did, which reflects overall satisfaction with the operation.

Facial deformity after parotid surgery is an important issue, but previous studies have failed to show a comparison of facial deformities.[12–15] This is to our knowledge the first study to report patients' satisfaction about the cosmetic result of parotidectomy. Satisfaction with cosmesis was improved when the hADM was inserted, there were no complications, and among female patients. However, there are potential limitations to this study, as it was retrospective, with a small sample size, and the insertion of hADM was chosen arbitrarily at the time of operation without randomisation

Conclusion

In parotid surgery for benign tumours, cosmetic outcomes are important in assessing satisfaction. When hADM was inserted after parotidectomy, the cosmetic outcome was improved. The inserted hADM was expected to prevent skin depression, and there was no evidence that it caused any complications. Insertion of hADM after parotidectomy was therefore expected to improve patients' satisfaction.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patients' permission

This study was approved by the Institutional Review Board of Gachon University Gil Medical Center (approval number; GAIRB2017-116). Patients' permission was obtained.

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