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Viability of full-thickness skin grafts used for correction of cicatricial ectropion of lower eyelid in previously irradiated field in the periocular region

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Abstract

Purpose—To evaluate the viability of skin grafts used for correction of cicatricial ectropion resulting from previous ablative surgery and radiotherapy for head and neck cancer and to report overall outcomes of cicatricial ectropion repair.

Methods—This is a retrospective, non-comparative case series of all consecutive head and neck cancer patients who had been exposed to high-dose radiation therapy in their periocular region and had surgical correction of their lower eyelid cicatricial ectropion through placement of a full-thickness skin graft and a lower eyelid tightening procedure by the same surgeon. The primary outcome measure was skin graft viability. Secondary outcome measures comprised of post-operative complications, the overall outcome of ectropion repair as judged by improvement in symptoms of exposure keratopathy and dependence on lubricating eye drops and ointments, as well as cosmetic improvement measured through a grading scale determined based on the degree of inferior scleral show and/or tarsal conjunctival eversion.

Results—25 patients were eligible for the study. 19 men and 6 women had a median age of 63 years (range: 20–84 years). All 25 patients had high-dose radiation therapy for their head and neck cancer. All but 1 patient had major cancer ablative surgery performed prior to radiation therapy. Thirteen of 25 patients also received chemotherapy. There was 100% viability of the skin grafts used for the repair of lower eyelid cicatricial ectropion. There were a few post-operative complications including the need for revision surgery to correct residual ectropion in the lower eyelid in 2 patients and a third patient required a revision surgery due to upper lid retraction and lagophthalmos after harvest of skin graft from the upper eyelid. Improvement was noted in the subjective symptoms in 22 of 25 patients (88%) while 17 patients (68%) were noted to have improvement in their clinical findings on slit lamp examination. All 20 patients for whom good quality photos were available had improvement in the degree of cicatricial lower eyelid ectropion as measured by the amount of inferior scleral show and tarsal conjunctival eversion, although 11 patients had some residual ectropion. All 20 had either good or excellent result in the appearance of their skin grafts.

Conclusions—Our findings suggest that full thickness skin grafts are a nice option for correction of cicatricial lower eyelid ectropion in a previously radiated field; 100% of the grafts

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survived. The majority of patients had improvement of ocular surface damage and symptoms, with a decreased dependence on topical lubricants. All evaluable patients had improvement in the degree of cicatricial lower eyelid ectropion, although close to one-half of patients had some mild residual ectropion. The majority of patients had excellent appearance of the skin graft.

INTRODUCTION

Damage to the periocular skin following ablative surgery and post-operative radiation therapy (XRT) for head and neck cancer may lead to eyelid malposition, most commonly cicatricial ectropion.¹ The clinical consequences of lower eyelid cicatricial ectropion are both functional and cosmetic and if left untreated, can lead to keratitis, scarring of the cornea and conjunctiva, globe perforation, and blindness.²

Surgical repair of cicatricial ectropion usually requires release of the scar tissue in the lower eyelid and upper face, a full-thickness skin graft, and resuspension of the lower eyelid to the lateral orbital rim sometimes combined with a medial canthopexy. However, the traditional thinking in plastic surgery is to avoid full-thickness skin grafts in heavily irradiated beds for fear of compromised blood supply and graft failure.³ In addition to graft failure, other potential complications of skin grafting may include partial failures related to hematoma formation, graft hypertrophy or contraction, and graft infection that could necessitate further revision.⁴

While several previous studies have reported skin graft-related complications in irradiated fields,⁵⁻⁹ no study to date, to our knowledge, specifically addresses the outcomes for skin grafting in the eyelid and periocular region. Our study aims to evaluate the viability of full-thickness skin grafts used for correction of lower eyelid cicatricial ectropion in previously radiated fields in head and neck cancer patients and to report overall outcomes of cicatricial ectropion repair.

PATIENTS AND METHODS

Study Design

This study is a retrospective, non-comparative case series of patients with head and neck cancer who had surgical correction of cicatricial ectropion of the lower eyelid by the same surgeon (B.E.) at The University of Texas M.D. Anderson Cancer Center from January 1999 to January 2010. The inclusion criteria were: a) diagnosis of cancer of the head and neck. b) Exposure to high-dose radiation therapy in the periocular region. c) Patient underwent surgical repair of lower eyelid cicatricial ectropion by the Principal investigator (BE) d) At least 6 months of follow-up after correction of the lower eyelid cicatricial ectropion. The electronic medical records and available pre- and post-operative photographs were reviewed for each patient.

Study Variables

In each case the following variables were recorded: age, ethnicity, gender, medical comorbidities, such as diabetes mellitus, hypertension, peripheral vascular disease, and tobacco and alcohol history, head and neck cancer diagnosis, location of cancer in the head and neck area, whether the tumor was primary versus recurrent.

Details of the prior head and neck ablative surgery, if one was performed, and the type of prior reconstructive surgery were also recorded. Information regarding adjuvant therapy, including induction or post-operative chemotherapy, and post-operative adjuvant radiation therapy was recorded in each case. The total dose of radiation, radiation modality, number of fractions and duration of radiation were recorded in each case. The time interval between the

completion of radiotherapy and the placement of the skin graft, donor site, and additional procedures needed to correct the ectropion were also recorded in each case.

Surgical Technique for Lower Eyelid Cicatricial Ectropion Repair

The surgical procedure started with the release of scar tissue and any adhesions to the orbital rim, to adjacent free flaps that may have been used for reconstruction of the lower facial structures, or hard-ware placed in the maxillary and orbital floor region. This step is done through a subciliary incision. In addition, a lateral tarsal strip procedure is performed to shorten and tighten the lower eyelid laterally, combined with a lateral tarsorrhaphy and/or a medial canthopexy, as needed, to further support the upward position of the lower eyelid (please see Table 4). The medial canthopexy technique used entailed placement of larimal probes in the canaliculi to avoid inadvertent damage to the lacrimal system followed by an incision just anterior to the canaliculi on the eyelid skin in the medial aspect of the upper and lower eyelids, followed by removal of a small strip of skin and muscle and closure of defect in two layers of deep absorbable sutures and a superficial layer of skin and muscle closure. In all but one patient in this study the anterior lamella was repaired, meaning that the tarsal layer was not reconstructed. In the remaining patient a tarsoconjunctival flap was done in addition to a full-thickness skin graft to correct the ectropion (Table 4). In all cases, a Frost-suture was placed at the eyelid margin that is attached to the forehead for the first 5 days after surgery to further stabilize the position of the lower eyelid and place the eyelid in upward traction during the early postoperative period. A bolster is placed over the skin graft and the eye is patched for a period of 5 days.

Outcome Measures

Primary outcome measure was skin graft viability. We defined graft viability as the survival of the initial skin graft without the need for the removal and/or replacement of the graft.

Secondary outcome measures comprised of post-operative complications including, but not limited to, bleeding, hematoma formation, graft hypertrophy, graft contraction, graft infection, time to failure, and the need for additional procedures.

Further secondary outcome measure included the overall outcome of ectropion repair as judged by improvement in symptoms of exposure keratopathy and dependence on lubricating drops and ointments.

Cosmetic improvement was determined through a grading scale determined based on the degree of inferior scleral show and/or tarsal conjunctival eversion. Our grading scheme was as follows: mild ectropion was defined as ≤ 3 mm of inferior scleral show without tarsal conjunctival eversion; moderate ectropion was defined as > 3 mm of inferior scleral show without tarsal conjunctival eversion; severe ectropion was any degree of inferior scleral show with eversion of the tarsal conjunctiva. Due to the variability in the magnification at which the clinical photographs were taken, the degree of inferior scleral show and tarsal conjunctival eversion was measured as a ratio of the vertical height of the cornea. We used 12 millimeters as the average vertical height of the cornea with 6 millimeters being the location of the corneal light reflex. For example, if the inferior scleral show was $1/3$ of the vertical height of the cornea, then it was calculated to be $1/3$ of 12mm, which equaled 4mm. If there was a difference between the lateral and medial aspect of the ectropion, then the area with the greatest inferior scleral show or tarsal conjunctival eversion was measured.

The skin graft appearance was also graded as poor, adequate, or excellent by evaluating the lid contour, color and texture match, and overall aesthetic quality of the graft as determined from clinical photos by a single observer (B.H.).

RESULTS

Twenty-five patients were eligible for the study. Table 1 outlines the demographic characteristics of the patients included in the study.

Table 2 summarizes the variables for the head and neck cancer diagnosis. The most frequent histology encountered was squamous cell carcinoma, with the most frequent location of the tumor being the maxillary sinus. The designation of the “periocular” region was given if the location of the tumor involved the eyelids, eyebrows, canthal region, and/or the cheek.

The type of cancer ablative surgery performed was variable but included, wide local excision, maxillectomy, ethmoidectomy, sphenoidectomy, parotidectomy, rhinotomy, total septectomy, frontal craniotomy, hemimandibulectomy, and orbital floor resection. One patient did not have cancer ablative surgery. Records for one patient regarding his ablative surgery at an outside facility could not be obtained.

Table 3 outlines the details of adjuvant treatments used for our cohort. All 25 patients had radiation therapy for their head and neck cancer. Thirteen of 25 patients also received adjuvant chemotherapy.

The radiation field was individually tailored for each patient's cancer, thereby resulting in extreme variability of the size and extent of the radiation fields but in each case the periocular skin and lower eyelid had been included in the field of radiation.. Other anatomic sites included in the radiation field included the forehead, jaw, periorbital skin, temple, parotid, lower neck, nasopharynx, maxilla, skull base, ears, and paranasal sinuses. Six patients received radiation therapy at an outside facility; thus limited information regarding details of radiation therapy was available for these 6 patients.

Table 4 outlines the clinical and surgical characteristics of the cicatricial ectropion. Additional intraoperative procedures designated as “other” in the table included gold weight placement, dacrocystorhinostomy, removal of a benign lid lesion, removal of an exposed titanium plate, brow lift, and/or entropion repair of the unaffected eyelid.

The primary outcome measure was defined as viability of the full-thickness skin graft in the previously irradiated lower eyelid. There was 100% viability of the grafts; I.e. there were no cases of skin graft failure or loss among the 25 patients in this report. Post-operative complications are outlined in Table 5. Two patients had small epithelial inclusion cysts in their skin grafts and 1 patient developed upper eyelid retraction at the donor site for the skin graft. Two patients required a revision surgery to correct residual ectropion in the lower eyelid, a third patient required a revision surgery due to upper lid retraction and lagophthalmos.

Improvement was noted in the subjective symptoms in 22 of 25 patients (88%)(Table 6). 17 patients (68%) were noted to have improvement in their clinical findings on slit lamp examination and on external examination (Table 6).

All 20 patients for whom good quality photos were available had improvement in the degree of cicatricial lower eyelid ectropion as measured by the amount of inferior scleral show and tarsal conjunctival eversion (Table 7), although 11 patients had some residual ectropion. The majority of patients had either good or excellent appearance of their skin grafts. No patient had a poor appearance of the graft.

Figures 1 and 2 show examples of severe cicatricial ectropion corrected with a full-thickness skin graft combined with a lateral tarsal strip procedure. In both patients highlighted in these

photos the position of the lower eyelid is significantly improved after surgical correction, the amount of epiphora is improved because of better position of the lower punctum, symptoms of foreign body sensation are resolved as well as lagophthalmos.

Discussion

Our findings suggest that full thickness skin grafts placed in a previously irradiated lower eyelid to correct cicatricial ectropion are quite viable with graft survival observed in all 25 patients. None of the 25 grafts required removal or replacement for the duration of each patient's postoperative follow-up. There were no graft complications of bleeding, hematoma formation, graft infection, graft hypertrophy, or graft failure. Three patients needed revision surgery for various reasons. The majority of patients had improvement of ocular surface damage and symptoms, with a decreased dependence on topical lubricants. All patients had improvement in the degree of cicatricial lower eyelid ectropion measured by the amount of inferior scleral show and tarsal conjunctival eversion, although close to one-half of patients had some mild residual ectropion. Lastly, the majority of the patients had excellent appearance of the skin graft.

The success of the skin grafts in our study is likely due to the small size of the grafts and the abundant blood supply of the periocular region. Our observations suggest that, at least in the periocular region, full-thickness skin grafts can be a viable option for correcting cicatricial ectropion of the lower eyelid even in a previously heavily radiated fields. Previous studies have indicated that previously irradiated beds are poor candidates for full-thickness skin grafts, due to the damage to the underlying vascular supply due to high-dose radiation therapy. This belief has dominated the surgical arena thereby resulting in flaps being considered the primary reconstructive choice in repairing defects in an irradiated field.^{8,9} Our study has explored the possibility of utilizing full-thickness skin grafts in a previously irradiated periocular region and suggests that full-thickness skin grafts combined with a lower eyelid tightening procedure may be a nice option for correcting cicatricial ectropion in the lower eyelid even after exposure to high doses of radiation.

Our surgical approach to correction of severe lower eyelid cicatricial ectropion in patients with head and neck cancer after high-dose radiation therapy to the periocular region is a slight modification of the techniques previously described for correction of cicatricial ectropion in general.¹⁰⁻¹³ We did not feel that a mid-face lift was necessary in the patients in this study but this additional step could be considered in patients with midfacial deformity or involutional changes. We recommend a wait period of at least 3 months between completion of radiotherapy and repair of cicatricial ectropion in the lower eyelid to allow for resolution of the acute inflammatory reaction that occurs in the facial soft tissue and skin during high-dose radiation delivery. The procedures described in this report for cicatricial lower eyelid ectropion repair can be done under monitored anesthesia care without a need for general anesthesia and can be easily done in the outpatient setting.

We recommend evaluation of head and neck cancer patients with lower eyelid cicatricial ectropion for consideration of appropriate procedures to repair the ectropion in order to achieve improvement in ocular symptoms and function, decrease dependence on lubricating drops, and decrease the degree of sclera show and possibly improve the degree of asymmetry in facial appearance.

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Figure 1.

A) External photograph of a patient with a history of maxillary sinus sarcoma after a total maxillectomy and high-dose post-operative radiation therapy. Note severe ectropion of the lower eyelid with exposure keratopathy. B) External photograph in the same patient after release of scar tissue, lateral tarsal strip procedure and a full-thickness skin graft harvested from the upper eyelid. Photograph taken 1 year after the repair of cicatricial lower eyelid ectropion.

Figure 2.

A) External photograph of a patient with a history of maxillary sinus squamous cell carcinoma after a total maxillectomy, a free flap, and postoperative high-dose radiation

therapy. Note severe ectropion of the lower eyelid, exposure keratopathy, and epiphora B) The patient has significant lagophthalmos (inability to close the eye completely). C) External photograph in the same patient after repair of the lower eyelid cicatricial ectropion using a full-thickness skin graft harvested from the upper eyelid and a lateral tarsal strip procedure. Photograph was taken 2 years after repair of cicatricial lower eyelid ectropion. D) The lagophthalmos is resolved.

Table 1

Demographic characteristics and past medical history

		N (total = 25)	%
Age (range)	Median =63 (20–84)		
Race	White	20	80.0
	Black	2	8.0
	Hispanic	3	12.0
Gender	Male	19	76.0
	Female	6	24.0
PMHx	DM	3	12.0
	PVD/CAD	8	32.0
	HTN	14	56.0
	Immunocompromised	3	12.0
Past Ocular History	Yes	5	20.0
Smoking history	Yes	14	56.0
Alcohol history	Yes	9	36.0

N= number; DM= diabetes mellitus; HTN= hypertension;

PVD/CAD= peripheral vascular disease/coronary artery disease; PMHx= past medical history.

Table 2

Characteristics of the primary head and neck cancer

		N (Total=25)	%
Histology	SCCa	11	44.0
	BCCa	3	12.0
	Melanoma	2	8.0
	SebCCa	0	0.0
	Lymphoma	1	4.0
	Sarcoma	5	0.0
	Other	3	12.0
Laterality	Right	16	64.0
	Left	9	36.0
Location of tumor	Periocular	7	28.0
	Maxilla/sinus	9	36.0
	Temple	1	4.0
	Nasal	3	12.0
	Combination	5	20.0
Primary vs. Recurrent tumor	Primary	11	44.0
	Recurrent	14	56.0

N=number; SCCa=squamous cell carcinoma; BCCa=basal cell carcinoma; SebCCa=sebaceous cell carcinoma

Table 3

Details of adjuvant radiation and chemotherapy

Adjuvant therapy			N	%
Chemotherapy	Type	Induction	8	32.0
		Post-operative	4	16.0
		Both	1	4.0
Radiation therapy	Type	External beam	17	68.0
		IMRT	5	20.0
		Unknown	3	12.0
	Duration (weeks± SD)		4.7 ± 1.6 (6 unknown)	
	Frequency (Fractions ± SD)		23.9 ± 10.7 (6 unknown)	
	Total Dose of Radiation (Gy ± SD)		53.9 ± 13.0 (6 unknown)	

Gy=grays; SD=standard deviation

Table 4

Laterality, donor site, and other procedures combined with repair of cicatricial ectropion

		N	%
Location	Right lower lid	16	64.0
	Left lower lid	9	36.0
Time to skin graft placement after completion of radiotherapy (in months)	Mean interval	40	
	Range	3–163	
Donor site	Ipsilateral upper lid	13	52.0
	Contralateral upper lid	8	32.0
	Bilateral upper lids	2	8.0
	Postauricular	2	8.0
	Tarsal conjunctival flap	1	4.0
Additional surgical procedures	Medial canthopexy	12	48.0
	Lateral tarsorrhaphy	18	72.0
	Canthal defect repair	1	4.0
	Release of scar tissue	25	100.0
	Frost suture	11	44.0
	Lateral tarsal strip	25	100.0
	Other	12	48.0

N=number; RLL=right lower eyelid; LLL=left lower eyelid; UL=upper eyelid

Table 5

Post-operative complications

Complications		N	%
Bleeding/hematoma		0	0
Graft hypertrophy		0	0
Graft contraction		0	0
Graft infection		0	0
Partial graft failure		0	0
Other	Graft cyst formation	2	8.0
	Upper eyelid (donor site) ectropion	1	4.0
Need for revision surgery		3	12.0

Table 6

Subjective symptoms and clinical findings preoperatively and their improvement postoperatively

	Subjective symptoms	N	%	Clinical findings	N	%
Pre-operative symptoms	FBS	10	40.0	Conjunctival injection	9	36.0
	Tearing	17	68.0	PEE	4	16.0
	Dry eye	10	40.0	SPK	9	36.0
	Redness	9	36.0	Exposure keratopathy	14	56.0
	Photophobia	1	4.0	NLDO	4	16.0
	Lubricating drops	17	68.0	Blepharitis	0	0
	Other	0	0	Other	0	0
Post-operative improvement	Yes	22	88.0	Yes	17	68.0
	No	3	12.0	No	8	32.0

FBS= foreign body sensation; PEE=punctate epithelial erosions; SPK=superficial punctate keratitis; NLDO=nasolacrimal duct obstruction

Table 7

Degree of cicatricial ectropion pre- vs. post-operatively

		Pre-operative	Post-operative	Mean difference (mm)
Mean amount of Inferior scleral show (mm)		3.4 Range: 2–8 mm	1.2 Range: 0–3 mm	2.0 Range: 1.5–7 mm
Mean amount of tarsal conjunctival eversion (mm)		1.5 Range: 0–3 mm	0.2 Range: 0–0.3 mm	1.4 Range: 1.0–2.5 mm
Residual ectropion		N/A	11	
Degree of ectropion	Mild	6	8	
	Moderate	5	0	
	Severe	9	3	
	None	N/A	9	
	Unknown	5	5	
Appearance of skin graft	Poor		0	
	good		9	
	Excellent		11	
	Unknown		5	