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BRIEF COMMUNICATIONS

Amniotic Membrane Transplantation to Reconstruct the Conjunctival Surface in Cases of Chemical Burn

Yasemin A. Katircioglu, Koray Budak, Sibel Şalvarli and Sunay Duman

Ankara Education and Research Hospital, Ankara, Turkey

Purpose: To evaluate the efficiency of preserved human amniotic membrane transplantation for conjunctival surface reconstruction in cases of chemical burn.

Methods: Preserved amniotic membrane transplantation was performed in 6 patients (6 eyes) having symblepharon and fornix insufficiency due to chemical burn. Amniotic membrane was sutured to the intact conjunctiva after the fibrotic tissue was excised. The fornix was reconstructed in cases having fornix insufficiency. These cases were followed up for 4–24 months.

Results: During the mean follow-up period (10 ± 7.37 months) adequate bulbar conjunctiva and fornix depth was achieved in 5 patients without recurrence and with mild fibrosis. In 1 patient who did not have a healthy conjunctiva preoperatively, conjunctival fibrosis and symblepharon recurred.

Conclusions: Preserved human amniotic membrane transplantation is a good alternative treatment method for conjunctival surface reconstruction in those cases with some healthy peripheral conjunctival tissue. **Jpn J Ophthalmol 2003;47:519–522**

Key Words: Amniotic membrane transplantation, chemical burn, conjunctival surface reconstruction, fornix insufficiency, symblepharon.

Introduction

Chemical burns with extensive involvement of conjunctiva are often resistant to treatment. Severe damage to the conjunctival cells usually results in severe dry eye and fibrosis of the subconjunctival tissue. Although various medical and surgical treatments have been developed, management of severe chemical burns remains unsatisfactory. Conjunctival reconstruction can be done either by autograft transplantation of ocular surface and mucous membrane grafts or by amniotic membrane transplantation. Availability of healthy autologous conjunctival tissue is usually limited in severe burns, and buccal, vaginal, and nasal mucous grafts all have a risk of infection and unacceptable cosmetic appearance. On the other hand, amniotic membrane has advantageous properties including anti-adhesive effects, pain reduction, and epithelization effects. The lack of immunogenicity of amniotic membrane and the ease in finding it are other characteristics of amniotic membrane.

Recent studies have shown that amniotic membrane is a good alternative for conjunctival reconstruction.[1–4]

The aim of this study was to evaluate the efficiency of preserved amniotic membrane transplantation for conjunctival surface reconstruction after severe alkali burns. The main achievement of this clinical study is the reconstruction of the fornix after alkali damage.

Material and Methods

This study was performed in the Oculoplastic Surgery Department at Ankara Education and Research Hospital Eye Clinic. Informed consent was obtained from each patient after the in-hospital ethics committee approved this study.

Six patients (6 eyes) were included in the study. Patient data are summarized in Table 1. All cases suffered from severe symblepharon due to alkali burn. There were 4 male and 2 female patients, and their average age was 18.5 ± 3.2 years.

Mean duration between injury and the surgery was 50 ± 64 months (range, 4 months–14 years). The initial

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Correspondence and reprint requests to: Koray BUDAK, MD, Kennedy cad. 60/8, GOP Ankara 06660, Turkey. Phone: 90-312-4684838; fax: 90-312-4689562; E-mail: kbudak@e-kolay.net

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Table 1. Clinical Data for 6 Patients Undergoing Amniotic Membrane Transplantation (AMT)

Case No.	Age	Sex*	Follow-up (mo)	Underlying Cause	Biomicroscopic Findings[†]	Surgeries Before AMT	Surgeries with AMT	Location and Graft Size	Visual Acuity[‡] Preop	Visual Acuity[‡] Preop	EMR Postop	EMR Postop	Outcome Success
1	24	M	24	Chemical burn	Severe symb + VC + mild vertical EMR	Z-Plasty (four times)	Fornix reconstruction	Superior 15 × 10 mm Inferior 10 × 10 mm	HM	HM	Mild	Normal	Success
2	18	M	8	Chemical burn	Severe symb + VC + mild vertical EMR	Z-Plasty	Fornix reconstruction	Superior 15 × 10 mm Inferior 10 × 10 mm	0.1	0.1	Mild	Normal	Success
3	18	M	6	Chemical burn	Total CS + severe symb + VC + total EMR	Mucous membrane grafting	Fornix reconstruction	Total	P+P+	HM	Severe	Severe	Failed
4	19	F	4	Chemical burn	Moderate symb + VC + mild vertical EMR + severe ptosis	Z-Plasty	Fornix reconstruction	Superior 15 × 10 mm Inferior 10 × 10 mm	0.1	0.1	Mild	Normal	Success
5	18	F	6	Chemical burn	Moderate symb + VC + inferior CE + mild vertical EMR	Z-Plasty	Fornix reconstruction Entropion reconstruction	Inferior 10 × 10 mm	1	1	Mild	Normal	Success
6	14	M	12	Chemical burn	Mild symb	–	–	Inferior 10 × 10 mm	1	1	Normal	Normal	Success

*M: male, F: female.
[†]Symp: symblepharon, VC: vascularized cornea, EMR: eye-movement restriction, CS: conjunctival cicatrization, CE: cicatricial entropian.
[‡]HM: hand movements, P+P+: only perception and projection of the light can be described.

clinical evaluation consisted of slit-lamp biomicroscopy to examine the eyelid, conjunctiva, fornices, and the cornea. Symblepharon was graded depending on the number of quadrants involved (mild: <1 quadrant, moderate: 1–2 quadrants, severe: >2 quadrants).[4] The limitation in motility was graded as "−4" when the eye was unable to move towards the midline and "0" when it was full. Eye movement restriction is summarized in Table 1.

In case 6, the patient was operated on in an early period (4 months after the injury) because there were no acute inflammatory signs on slit-lamp examination.

Human placenta was obtained after elective cesarean delivery from patients who were previously tested with negative results for human immune deficiency virus, human hepatitis types B and C, and syphilis. The placenta was cleaned of blood clots with sterile saline solution containing 50 μg/mL of penicillin, 50 μg/mL of streptomycin, 100 μ(g/mL of tobramycin, and 2.5 μg/mL of amphotericin B. The amnion was then separated from the chorion by blunt dissection and spread on cellulose acetate paper, with the epithelium/basement membrane surface up. The membranes were stored at 80ºC in Dulbecco modified Eagle medium and glycerol in a ratio of 1/1 (v/v).

All the surgeries were done by one of us. Surgery was performed with the patient receiving retrobulbar anesthesia using 2% lidocaine. At the time of the surgery fibrotic areas of conjunctiva and subconjunctival tissue were excised. In cases of corneal and limbal involvement, the cornea was left untouched until a second intervention in order to perform less aggressive surgery.

Amniotic membranes were sutured to the defective area with interrupted absorbable (vicryl 8.0) sutures, each with episcleral anchorage. The fornix was reconstructed using 5.0 nonabsorbable sutures. After the surgery, 0.1% fluorometholone eye drops four times a day for 1 month, 0.3% ofloxacin eye drops four times a day for 2 weeks, and preserved free tears substrate 4 times a week during follow-up were prescribed. Fornix sutures were removed 1 week after the operation. Patients were followed up at 1 day, 1 week, 1 month, 3 months, 6 months, 1 year, and 2 years following surgery, and outcomes were graded by a neutral observer (not the operating surgeon).

Results

After a mean follow-up period of 10 ± 7.37 months, in 5 patients (cases 1,2,4,5, and 6), the smooth, wet appearance of the conjunctiva with slight fibrosis was observed (Table 1) (Figure 1). Lagophthalmos in the fifth patient improved after the operation. Epithelization of the

amniotic membrane surface was completed in 2 weeks. Slight injection and vascularization were observed at the surgical site as findings of inflammation 2 weeks after the surgery. The inflammation resolved 1 month after surgery. It was also detected that eye movements were improved and a deeper fornix was achieved. In case 3, whose conjunctiva was totally fibrous preoperatively, the symblepharon recurred 3 weeks after surgery. In this patient we were unable to find any intact conjunctiva due to the severe alkali burn.

Discussion

Chemical injuries of the eye are usually classified as the most dangerous injuries in ophthalmology and usually result in severe anterior segment complications and visual impairment. Because the alkalis are scarcely neutralized by the tear film and have the potential to remain a long time in the fornix of the conjunctiva, they can easily penetrate the eye and damage the ocular surface, corneal stroma and endothelium, limbal stem cells, as well as other anterior segment structures such as iris, lens, and ciliary body.

Transplanted amniotic membrane seemed to promote normal conjunctival epithelization while preventing excessive subconjunctival fibrosis formation. There was evidence that the collagen in the amniotic membrane probably serves as substrate for the conjunctival epithelization.[5] Postoperatively amniotic membrane becomes indistinguishable from subconjunctival tissue once it is covered by the conjunctiva.

The mechanism of the amniotic membrane transplantation for the suppression of subconjunctival fibrosis has not been fully understood. Shimazaki et al[6] speculated that it could act as a mechanical barrier to scar formation and/or growth factors produced by amniotic epithelial cells may modulate proliferation and differentiation of stromal fibroblasts. Other advantages of amniotic membrane transplantation are its unlimited availability, absence of human leukocyte antigens, its antimicrobial properties and its protective effect against excessive subconjunctival fibrosis formation.

Several studies have suggested amniotic membrane transplantation for ocular surface reconstruction.[1–4] Tseng and coauthors observed that in their 5 patients with symblepharon,[1] amniotic membrane transplantation was effective in patients who had relatively healthy conjunctiva. Honovar et al[4] reported the resolution of cicatricial entropion in 4 of 5 eyes and release of symblepharon in 9 of 10 eyes by amniotic membrane transplantation in patients with Stevens-Johnson syndrome.

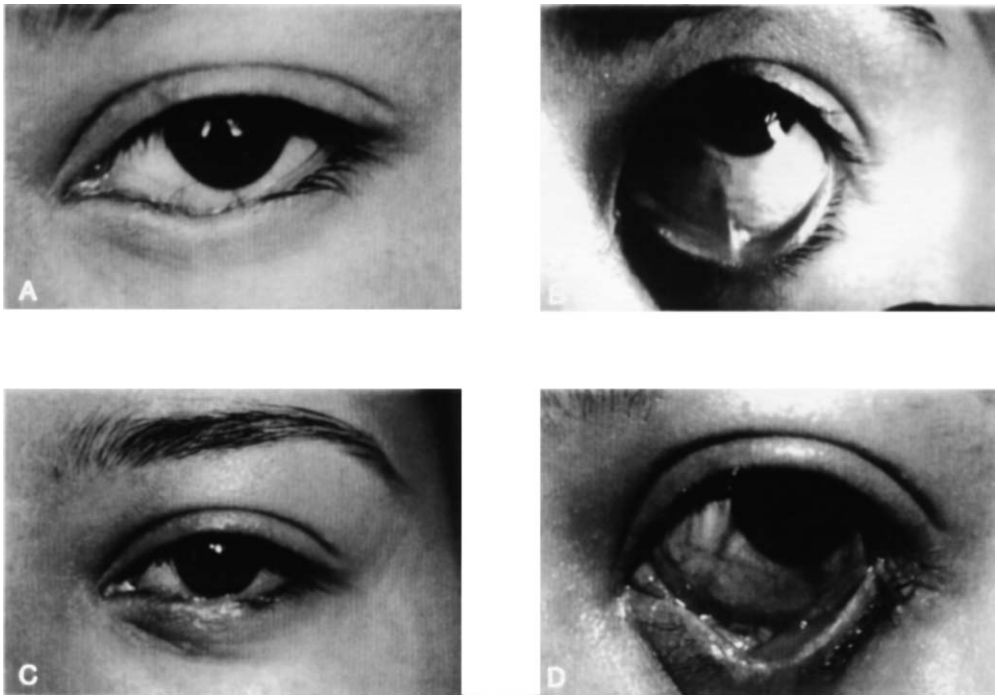

Figure 1. (**A**) Cicatricial entropion in case 5 before amniotic membrane transplantation. (**B**) Symblepharon in the inferior fornix in case 5 before amniotic membrane transplantation. (**C**,**D**) Postoperative resolution of cicatricial entropion and symblepharon in case 5 two weeks postoperatively.

Jpn J Ophthalmol
Vol 47: 519–522, 2003

Our study was aimed at only the conjunctival surface reconstruction by using amniotic membranes in order to, firstly, obtain a healthy ocular surface for tear production by the surface reconstruction. Limbal stem cell transplantation was planned for further surgery later. All the patients suffered from severe chemical burn and had severe conjunctival scarring. Five of the 6 patients responded well to the amniotic membrane transplantation: Transplanted amniotic membrane seemed to promote conjunctival epithelization and prevent excessive subconjunctival fibrosis formation. Amniotic membrane becomes cosmetically indistinguishable from subconjunctival tissue after it is covered by conjunctiva. The only patient for whom amniotic membrane transplantation failed had no healthy conjunctiva.

According to our results, the stage of the injury (acute or chronic phase) did not affect the prognosis. However, the presence of intact conjunctiva did improve the surgical outcome. In conclusion, we suggest that amniotic membrane transplantation is effective in symblepharon and fornix rehabilitation in patients who have relatively healthy conjunctiva.

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