Author's response to reviews

Title: A modified surgical technique in the management of eyelid burns: a case series

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Version: 3 Date: 22 October 2010

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A modified surgical technique in the management of eyelid burns: a case series

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Abstract:

**Introduction:** Contractures, ectropion and scaring are the common sequelae of skin grafts after eyelids burn injuries, results in corneal exposure, corneal ulceration and even blind. Split-thickness or full-thickness skin grafts are commonly used for the treatment of acute eyelid burns. Plasma exudation, infection is common in early skin graft after burns which decrease the success rate of grafts.

**Case presentation:** Eight patients age from 21-55 years old with second and/or third degree eyelid burn injuries were treated with a modified method by separate and loose the musculus orbicularis oculi between tarsal plate and septum orbital, and grafting a large full-thickness skin graft in three days after burn injury. The entire grafted eyelids were succeeded by one-time graft and in good conditions by six months follow-up.

**Conclusion:** This new technique is good for the eyelid burn injury, especially in the treatment of flame eyelid burn injury.

**Introduction**

Eyelid involvement is common in facial burns. Eyelid burn injuries need great care for the protection of the cornea. Burns damage tissues primarily by denaturing and coagulating cellular proteins and through vascular ischemic damage[1]. Most etiologic agents of eyelid burns are thermal and chemicals and a part of systemic burns[1,2]. Patients with burns involving the face also have burns of the eyelids. Approximately 15-20% of patients with facial burns exhibit ocular injury. Most eyelid burns are the result of exposure to fire. In developing country, 80% of chemical burns were due to industrial and/or occupational exposure. Approximately 60% eyelid burn developed eyelid contractures and eyelid ectropion, led to loss of protection of cornea[3]. The results cornea exposures are corneal ulcerations, corneal perforation, cataracts, glaucoma, scarring of cornea and loss of vision at last. These complications are more often happened in chemical burn patient by direct contact to chemicals. One third of corneal transplants were needed for sustained chemical injury, but the success rates were less than 50%. Some patients even need 4-5 transplants before success is achieved. About 15% eyelid burn patients would blind if not treated
Early management is critical in the eyelid burn patient, including non-surgical
gagements-artificial tears, moist gauze covering eyes to prevent drying of the
cornea. Early eyelid surgical management is usually delayed by deal with the body
burn injuries, this result in the eyelid contractures and eyelid ectropion. Early
management of eyelid burn is critical for the protective on cornea. A modified surgical
method was used by us to treat eyelid burn injuries in eight eyelid burn patients.
The eyelid contractures, eyelid ectropion, and cornea transplantation were avoided,
and the eyes vision and cosmetic appearance were in good conditions in all patients
followed by six months.
Case presentation

Eight patients (Six male, two female) with second and/or third eyelids burned, five of which with musculus orbicularis oculi burned but the tarsal plate were intact. Seven patients were flame burned; two of them affected 70%-80% BSA, and 40%-50% in third degree; the other five patients burned affected 7%-10% BSA in third degree, involved heads and hands. One patient burned by sulphuric acid in third degree on the face. Age ranged 21-55 years old, median age 37.

All patients were hospitalized and treated with artificial tears, moist gauze eye covering, antibiotic oculentum application to eyes twice a day for three days. Eyelid surgery was performed three days after burn injury. Surgery after three days of burn injury can avoid large amount plasma exudation which can influence the skin grafting success.

Local anesthesia was performed with 1% lidocaine. A horizontal incision were performed parallel the palpebral margin and above the palpebral margin 2-3 mm. The two side of incision pass inner and outer oculi medialis 5 mm. The periorbital areas were dermabraded. Separated and loosen the musculus orbicularis oculi between tarsal plate and septum orbital use a fine scissors. This technique can loosen the musculus orbicularis oculi, enlarge the eyelid space by 5mm. A 15-20 mm wide and 1/5 longer than eyelid, full-thickness skin graft was grafted and fixed with 3-0 suture. The grafted skin were harvested from inguinal area or thoracal area. The blood was cleaned and covered with 10% povidone-iodine gauze. Remove suture after 10 days. (Figure1-4)

16 eyelids of eight patients were all succeed. The appearance, opening and closing of eyelids were well and the protective functions were fully restored. There were no eyelid contractures and ectropion by six months follow up. One patient’s pre- and post-operative pictures were included. (Figure 5-7)

Discussion
Eyelid involvement is common in facial burns. Eyelid burn injuries especially by chemical contact are critical emergency. Priority is always given to eye closure, oral continence, neck and limb movement[5,6]. The acute management includes gentle eyelid and eyelash hygiene to prevent crusting. Topical ophthalmic antibiotic ointments and artificial tears should be applied frequently. The upper eyelid is responsible for moistening the cornea. Patients with eyelid burns should be examined daily especially while asleep. When the patient is asleep the voluntary component of lid closure is lost and the cornea may be partially exposed when it is completely closed in daytime. Tarsorrhaphy was advocated for corneal protection in the past, but it could not prevent lid retraction in the long term run, it also could not instead of timely skin grafting.

The optimal time to do skin graft on eyelid for deep second or third degree burn injury is still in controversy. Most surgeons suggest graft as early as possible. Early skin graft increasing the risks of infection and complications. Delayed skin graft increase the risk of eyelid hypertrophic scarring, asymmetry and other deformities then lead to eyelid contractures and result in cornea exposure[7, 8, 9].

Skin grafting we did were three days after burn injury, large amount exudation could be avoided at this period, which could influence the skin grafting success. It also could avoid large and firm scar formation and further eyelid contractures in the future[9,10].

The incision we did was 5mm longer in each side than usual, which can longer the graft by 10mm. We also widen the grafting area by Separated and loosen the musculus orbicularis oculi. With this modified method, eyelids can avoid ectropion even future contracture happened. Skin grafts we used were full-thickness instead of split-thickness skin grafts can even lower the ectropion incidence and lower corneal exposure[7].

Eyes could close completely even a little retraction may happen after surgery with this technique. The grafted eyelids appeared more cosmetic in double folds instead of single fold because larger skin grafts were used. Only one patient in this group was chemical burn injury, we need test more chemical burn injury patient with this method to testify if it works as good as in flame burn injury.
Conclusion

This new technique is good for the eyelid burn injury, especially in the treatment of flame eyelid burn injury. The result for the chemical burn injury need more test.

Competing interests
All authors declare that they have no competing interests.

Consent
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Authors' contributions
HL and YJ designed the surgical procedure. QW and SD worked as term member. Youxin Ji wrote the manuscript. All authors read and approved the final manuscript.

References
Reference;


Fig. 1: Incision by the dashed line
Fig. 2: Separate till tarsal plate, the graft skin on upper lid
Fig. 3: Separate till tarsal plate, the graft skin on lower lid
Fig. 4: Close eye and covered after grafting
Fig. 5: Pre-Operative view
Fig. 6, 7: Open and close eyes, 7 months after surgery