

# A lateral tarsorrhaphy with forehead hitch to pre-empt and treat burns ectropion with a contextual review of burns ectropion management

Nikolaos S Lympieropoulos, Daniel J Jordan, Ranjeet Jeevan and Kayvan Shokrollahi

## Abstract



**Introduction:** Facial burns around the eyes and eyelid ectropion can lead to corneal exposure, irritation, dryness, epiphora, infection or visual loss. We undertook a review of the published articles describing management of eyelid burns as well as methods to treat or prevent ectropion. We describe early experience of a surgical technique that we have found to mitigate ectropion in facial burns with peri-ocular involvement.

**Materials and methods:** Two illustrative cases with our surgical technique is described from our experience of three cases. We reviewed the literature using the PubMed and EMBASE databases using the search terms 'burn' and 'ectropion'.

**Results:** The literature review produced a total of 17 relevant papers. Treatment options for eyelid burns were varied and were invariably level 4 or 5 evidence. Various techniques were used to treat eyelid burns including the use of a full thickness skin graft with or without concurrent scar contracture release but also use of a local flap reconstruction with or without a tissue expander or release of the underlying muscle. Other techniques included canthoplasty, Z-plasty, forehead flaps, fat transfer, and tarsorrhaphy with full thickness skin grafting. In general, the focus of articles was therapeutic and reconstructive rather than pre-emptive/preventative management.

**Procedure:** We describe our early experience of a novel technique for temporary lateral tarsorrhaphy with forehead hitch which protects the globe and counters the scar- and gravity-related ectropic effects on the lower eyelids.

**Discussion:** Facial burns pose a difficult problem to the burn surgeon, especially when the eyelids are affected, both directly or indirectly. The optimal surgical management of eyelid burns remains unclear and the literature base lies mainly in the domain of case series. We review the literature on this subject and tabulate our findings and also describe our contribution to this area with a method of lateral and lower lid elevator that we have found valuable.

## Keywords

Burn, face, ectropion, eyelid, tarsorrhaphy

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## Lay Summary

**Background to this subject:** Managing facial burns and burn ectropion which is drooping and pulling down of the lower eyelid can be challenging. We undertook a review of the published articles to manage eyelid burns as well as methods to prevent ectropion. We describe a surgical technique that could improve the management of these cases

**Details of how the work was conducted:** We reviewed all studies by searching databases using terms 'burn' and 'ectropion'. An illustrative case with our surgical technique is described.

**What we did and did not learn from this study:** A total of 17 studies were found to match our criteria. Treatment options involved a number of different techniques but the optimal surgical management of eyelid burns remains unclear. Here we describe our initial experience of a novel technique to prevent ectropion and to protect the eye from any injuries.

**Discussion:** Facial burns pose a difficult problem to the burn surgeon, especially when the eyelids are directly or indirectly affected. We review the literature on this subject and tabulate our findings and also describe a new method that we have found valuable.

## Introduction

The management of facial burns around the eyes can be challenging, due to the relative laxity and mobility of eyelid skin and soft tissues, the contractile forces resulting from scarring of the rest of the face can easily distort the normal anatomy and lead to significant long-term deformity. Furthermore, ectropion leading to inadequate eyelid closure can result in corneal exposure, irritation, dryness and infection or visual loss.

Tarsorrhaphy is sometimes required as an early option in severe eyelid burns to protect the cornea prior to further surgery or a secondary option to facilitate treatment of contracture and this can be partial or complete.

We undertook a review of the literature on techniques that manage or prevent burns-related cicatricial ectropion and also describe a surgical technique we have used in three cases to mitigate ectropion with a number of other actual or potential benefits including protection of the globe through partial tarsorrhaphy and some iatrogenic brow ptosis, and stabilisation of the lower lid to facilitate skin graft take. This approach consists of a modified lateral tarsorrhaphy technique in which the key sutures are placed first in the eyelid and then hitched to the supra-brow skin. This is used as a therapeutic manoeuvre to protect an exposed globe and a prophylactic measure to minimise lower eyelid contraction and stabilise a skin-grafted lower lid, while not totally obliterating vision. The only published alternative prophylactic measure extraneous to the eyelid is use of facial masks to compress and lift the mid-face, but application of this technique is limited especially in the critical phase of early skin graft take of the face (causing shearing of

grafts) or eyelids, and has the potential for significant adverse complications including pressure necrosis of the facial skin.

## Materials and methods

### Literature review methods

All eligible studies published between June 1983 and 30 June 2013 were first identified by searching both the PubMed and EMBASE databases. For these searches, we used the MESH terms 'burn' and 'ectropion'. The same terms were used to search Google Scholar for additional papers that the initial search may not have captured. The search was limited to studies published in English. We reviewed the abstracts of all identified studies to exclude those that were clearly not relevant. The full text versions of the remaining papers were then reviewed to determine whether they met the study inclusion criteria. No attempt was made to identify unpublished literature, for example, techniques only presented orally or as posters at scientific meetings.

### Technique methods

Prophylactic temporary partial lateral tarsorrhaphy with forehead hitch: A 4-0 nylon or Prolene suture is placed as a horizontal mattress suture through the lateral upper and lower eyelids. The suture is secured with a deep bite of the soft tissues of the forehead but not affixed to the periosteum. This produces some elasticity in the biomechanics to avoid too much tension on the tissues and a little downward traction of the brow can assist in protecting the orbit as well, similar to when Botox is used to cause brow and

upper eyelid ptosis to protect the globe after facial palsy.<sup>1</sup> The eyelid suture takes a bite of the anterior lamella of the tarsal plate and hence protects against cheese-wiring, and additionally a mattress suture diffuses the tension. This has not been an issue and bolsters are not required. Instead of cutting this suture short, it is kept to length and further sutured and then tied to the forehead or eyebrow area in a vertical and slightly lateral axis to appropriate tension. We illustrate the technique with reference to two of the three cases in which it has been used.

## Results

### Literature search

The initial PubMed and EMBASE searches for the terms 'burn' and 'ectropion' revealed 97 studies of potential interest. No additional papers were found using Google Scholar.

Two of the authors independently reviewed the titles and abstracts of all 97 papers. Consequently, 80 were excluded as they were deemed not directly relevant. The remaining 17 papers which actually discussed the management of burn injuries to the eyelids with subsequent ectropion, were then analysed.

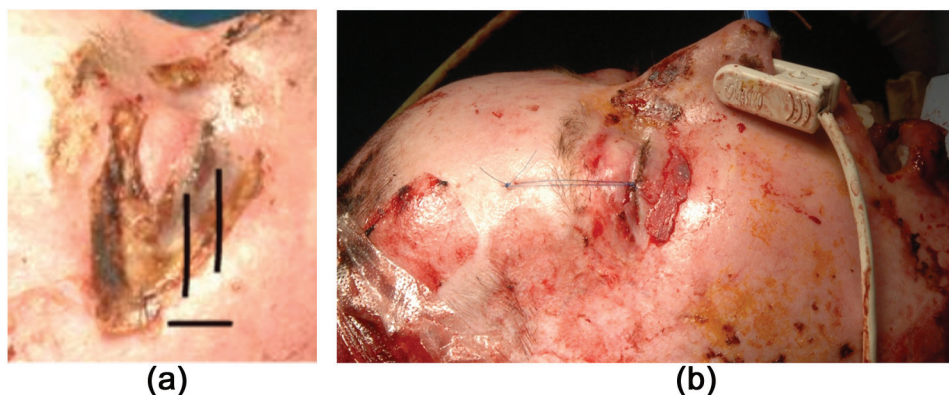
A further search involving the MESH terms 'burn', 'ectropion' and 'tarsorrhaphy' generated one further paper but this was excluded as it did not discuss a surgical technique.

### Case reports: our experience

Here we describe our experience of a novel technique for temporary lateral tarsorrhaphy to help minimise subsequent ectropion formation and to protect the cornea in the acute phase.

### Case study 1

A 19-year-old woman was transferred to our regional burn unit with mostly full thickness 96% total body surface area (TBSA) burns and extensive facial involvement, requiring skin grafts to the left cheek and both lower eyelids. Apart from the challenges involving the overall treatment and survival of this severely injured patient, the need to optimise her psychosocial recovery was identified and addressed at an early stage. Early ectropion of the lower eyelid was observed just 3 weeks following her initial injury with signs of corneal exposure in the context of facial and lower eyelid burns. Given the extent of the injuries and the anticipated need for multiple operations to treat the remainder of her burn injuries, it was thought best to minimise the need for further operations to treat imminent eyelid scar contracture at the time of facial and lower eyelid grafts. Achieving optimal healing of the face with a good cosmetic result and without the need for delayed surgical intervention was thought likely to have a major functional and psychosocial impact during her recovery. There were early signs of ectropion with corneal exposure bilaterally and skin grafts were required on both lower lids and the right cheek. We therefore sought not only to protect the cornea but also to stabilise and elevate the lower lid. We therefore undertook a lateral tarsorrhaphy with a horizontal mattress stitch being placed in each eyelid between and including the anterior lamella of the tarsal plate. Instead of cutting this suture short, we hitched the suture with a big bite to the skin of the supra-brow area using a non-absorbable suture material (Figure 1). This countered the scar- and gravity-related ectropic effects on the lower eyelids and protected the cornea from exposure, and also provided a mild

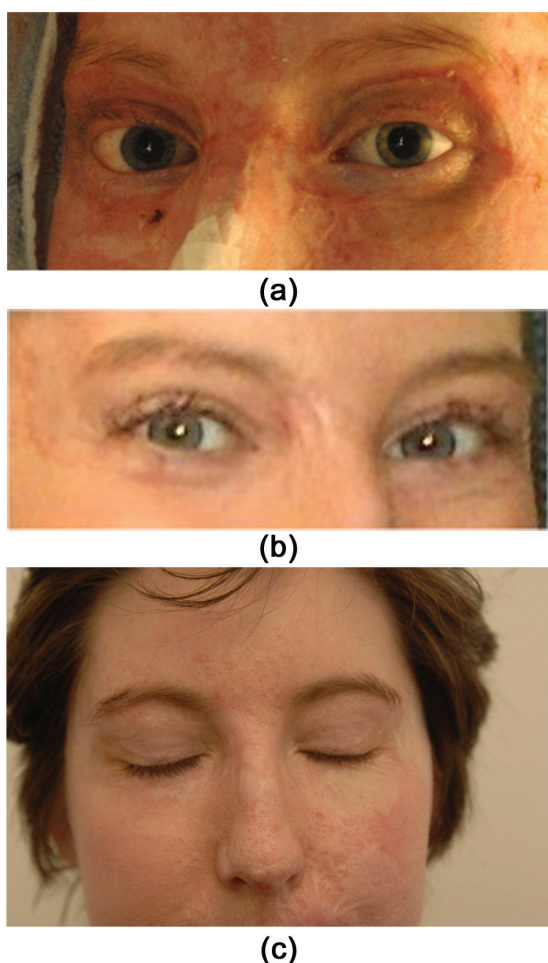


**Figure 1.** (a) Two millimetres of corneal exposure with thin strip of contracted lower eyelid burn at 4 weeks post 96% burns. (b) Delayed bilateral eyelids lateral tarsorrhaphy with forehead hitch technique with split skin graft to residual contracting lower eyelid at week 4.



iatrogenic brow ptosis effect to further assist in eye closure (not dissimilar to the anti-ectropic use of Botulinum Toxin in facial palsy-related corneal exposure).

The sutures were kept in position for 2 weeks, from the 4th week to the 6th week following the initial injury, at which point the patient was being weaned from sedation. We found that the modified technique protected the eyelid anatomy from further distortion and corrected the changes we noted before its implementation; the eyelid skin grafts took well and resulted in excellent cosmetic and functional outcome. The results with photographs at various timescales after lower eyelid and facial skin grafts with adjunctive forehead hitch tarsorrhaphy are presented in Figures 2 and 3.



**Figure 2.** (a) At 5 months post injury with 1 mm of residual right lower eyelid ectropion when eyes open after split skin grafts to both lower eyelids, right cheek and right malar with tarsorrhaphy technique. (b) Resolving right lower eyelid ectropion at 7 months. (c) Normal eyelid closure maintained at 12 months.



**Figure 3.** Excellent functional and cosmetic result at 18 months.

### Further experience

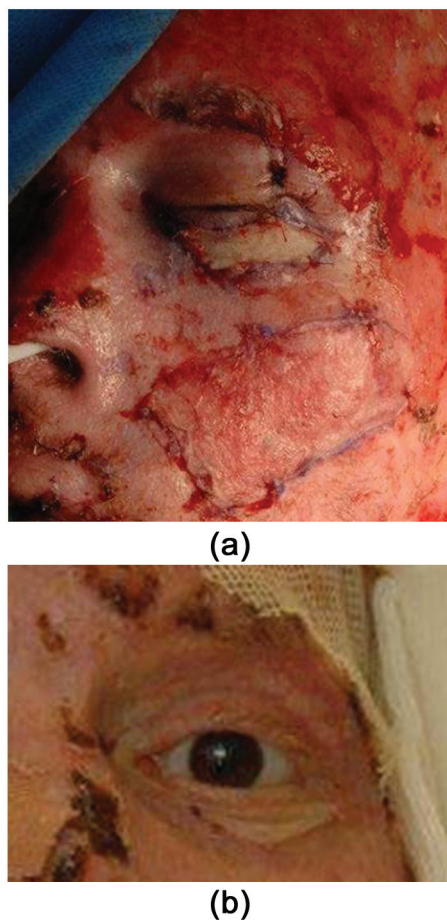
This technique has since been utilised in further cases where early eyelid contractures were noted in 40% TBSA burns involving the face and another patient with 60% upper torso and facial burns. Again, concern regarding lower eyelid ectropion was noted at week 3, with the same technique including lower eyelid skin grafts utilised (Figure 4).

To counteract the cheese-wiring through the eyelid skin, it is necessary to incorporate the tarsus but avoid breaching the mucosa-conjunctiva. A bolster was traditionally recommended using a dental roll or silastic or narrow bore plastic tube, but we did not have problems dispensing with this so long as the suture bites were as described. Suture placement is above the hair-bearing part of the brow. Large series of severe facial burns in a single unit are relatively uncommon, but in the initial three cases we have undertaken to date, the results have been promising. We acknowledge that we are joining the rest of the evidence base in this arena in level 4–5 evidence.

### Discussion

#### Literature review

We have listed and summarised all of the included studies in Table 1. It is clear from their scope and differing approaches that the optimal surgical management of eyelid burns remains unclear. The 17 relevant papers presented a number of different surgical options undertaken at markedly different time points. The level of evidence was not higher than 4 as most of the



**Figure 4.** (a) Patient with full thickness skin graft to lower eyelid with lateral tarsorrhaphy and forehead hitch. (b) Patient with full thickness skin graft to lower eyelid with lateral tarsorrhaphy and forehead/eyebrow hitch after 9 weeks.

studies were case series and case reports. The range of surgical options with which to treat burn ectropion are summarised in Chart 1. We have to note that only corrective measures were described and no prophylactic techniques were mentioned. Depending on the particular challenges that surgeons faced with each particular facial burn injury, sets of modifications have been described. It has been suggested that operative decision-making should take into account the anatomy of the scar, as the key to a good result involves releasing all of the extrinsic and intrinsic contractures that may arise.<sup>2</sup> The first group of treatment options involved the use of a full thickness skin graft with or without concurrent scar contracture release.<sup>2-9</sup> The second group described the use of a local flap reconstruction with or without a tissue expander or release of the underlying muscle.<sup>2,6,10-14</sup> Other techniques included canthoplasty,<sup>14</sup> a combination of a Z-plasty with full thickness skin

grafting,<sup>15</sup> forehead flaps,<sup>10</sup> fat transfer<sup>16</sup> and tarsorrhaphy with full thickness skin grafting.<sup>17</sup> Where grafting was required, most authors preferred full thickness skin grafts to split thickness skin grafts, as might be expected due to their relative rates and degrees of subsequent contracture. For a combination of an eyelid release and grafting, an upper eyelid skin crease incision is described as the lower border of the graft. For both upper and lower eyelids, dissection should be ‘canthus-to-canthus’ and extend up to 2 cm beyond the lateral canthus, angulated very slightly upwards for lower eyelid incisions and well into the nose at the inner canthus.

All of the papers reported attaining satisfactory outcomes, but the use of a wide range of outcome measures made it difficult to assess the relative effectiveness of different approaches. For this reason, we identified which techniques were used most commonly in the combined total of 260 patients whose treatments were reported in the 17 papers. The results are summarised in Chart 2, and the descriptors of outcome were usually subjective or descriptive.

In total, satisfactory results were obtained in 64 of the 260 patients using tissue expansion followed by a local flap to reconstruct the eyelids.<sup>2,6,10-12</sup> Satisfactory results were obtained using a simple full thickness skin graft in 55 patients,<sup>2,5,7,9</sup> while a combination of graft or flap with deep release of the contracture was used for a further 41 patients.<sup>2,10,11,18</sup> The remainder were treated using a variety of distinct reconstructive techniques outlined above.

The additional search with the addition of the term ‘tarsorrhaphy’ yielded one further paper.<sup>19</sup> Tarsorrhaphy is well described as an effective technique to aid eye closure and this is indicated in patients where there is lagophthalmos and a poor Bells phenomenon, a large eyelid defect or where there is no improvement in lid closure over a 24-h period.<sup>20</sup>

Hollsten<sup>19</sup> describes a double suture being passed through the grey line of the lower lid 1 cm apart, being passed through the grey line of the upper eyelid and emerging 1 cm below the brow-line. These can be tied or taped to the forehead as well as the addition of a lower lid bolster to reduce risk of the suture cheese-wiring through the lower lid. This ‘draw-string’ tarsorrhaphy lasts approximately 2 weeks before cheese-wiring does occur through severe eyelid burns. An alternative option is to reverse the direction of the sutures finishing with a suture pass through the periosteum of the inferior orbital rim.<sup>20,21</sup> A lateral tarsorrhaphy has also been defined, which maintains

**Table 1.** Summary of the systemic review papers and results.

Authors	Title/Objective	Year	Level of evidence	Patients (n)	Type of surgical treatment used	Results and suggestions
Tahir et al.	Chemical burns from assault: a review of seven cases seen in a Nigerian tertiary institution	2012	4	6	4 ectropion release with full thickness skin graft (FTSG)	In facial resurfacing, early full thickness skin grafting is preferred over split thickness graft because of better aesthetic results
Liu et al.	[Application of facial tissue expander fibrous envelope for tension reduction]	2012	4	21	Tissue expander with flap reconstruction	Satisfactory results. In skin soft tissue expansion of the face, the fibrous envelopes at the base could reduce the tension of the incision and prevent the deformity of the mouth and lower eyelids
Wetton et al.	A split forehead flap for the treatment of resistant bilateral upper and lower eyelid ectropion postburn injury	2012	4	Case report	Split forehead flap	The split forehead flap definitively corrected the ectropion in this case
Philp et al.	Late outcomes after grafting of the severely burned face: a quality improvement initiative	2012	4	35	The surgical approach included tangential excision based on the facial aesthetic units, temporary cover with allograft then autografting with scalp skin preferentially, split grafts for the upper eyelid and FT grafts for the lower eyelid	Grafted eyelids required one or more subsequent ectropion releases in the majority of cases
Sankale et al.	[Paediatric head and neck burns sequelae].	2011	4	27	Surgical treatment was used in 55.7% of the cases: Z-plasty, followed or not followed by skin graft for adhesion treatment, as well as adhesion lysis followed by grafting for eyelid ectropion treatment	The surgical outcome was satisfactory despite three cases of complications (20%). Any improvement in prognosis in such burns depends on improvements in the quality of initial care and on raising parents' awareness of accidents in the home

**Table 1.** (Continued)

Authors	Title/Objective	Year	Level of evidence	Patients (n)	Type of surgical treatment used	Results and suggestions
Liu	A modified surgical technique in the management of eyelid burns: a case series	2011	4	8	Modified surgical procedure consisting of separation and loosening of the musculus orbicularis oculi between tarsal plate and septum orbital, followed by grafting a large full-thickness skin graft in 3days after burn injury	This new surgical technique is highly successful in treating eyelid burn injuries, especially flame burn injuries of the eyelid
Belba et al.	Head and neck burns: acute and late reconstruction.data of burn injury management in 2007	2008	4	81 overall but 10 eyelid deformities	Scar revision 49% debridement and grafting 16% a split-thickness skin graft 12% of full-thickness skin graft in 8%; a skin expanded 8%; other procedures	Author does not comment on surgical technique outcome
Egeland et al.	Management of difficult pediatric facial burns: reconstruction of burn-related lower eyelid ectropion and perioral contractures	2008	4/5	Report/Review	Contracture release, subperiosteal midface suspension, reconstruction of orbicularis + -flap and full or slit thickness skin graft	Highlights the importance of releasing extrinsic and intrinsic contractures
Caviggioli et al.	Correction of cicatricial ectropion by autologous fat graft	2008	4	Case report	Injection of adipose tissue harvested from abdominal subcutaneous fat and processed according to Coleman's technique	At the 1-year follow-up assessment after lipostructure, the patient no longer reported xerophthalmia
Chen et al.	Repairing of lower eyelid ectropion with expanded flap	2008	4	40	Tissue expander for 2–3 months, then advancement or transposition flap reconstruction	After 2-year follow-up all patients had satisfactory results and no recurrences with appearance
Sharma et al.	Severe post thermal burn cicatricial ectropion with corneal ulceration: an illustrative case	2005		Case report	Delayed presentation of corneal ulceration associated with ectropion. Full thickness skin grafting and tarsorrhaphy	Full thickness skin grafts and tarsorrhaphy are effective in correcting upper lid cicatricial ectropion, without functional compromise

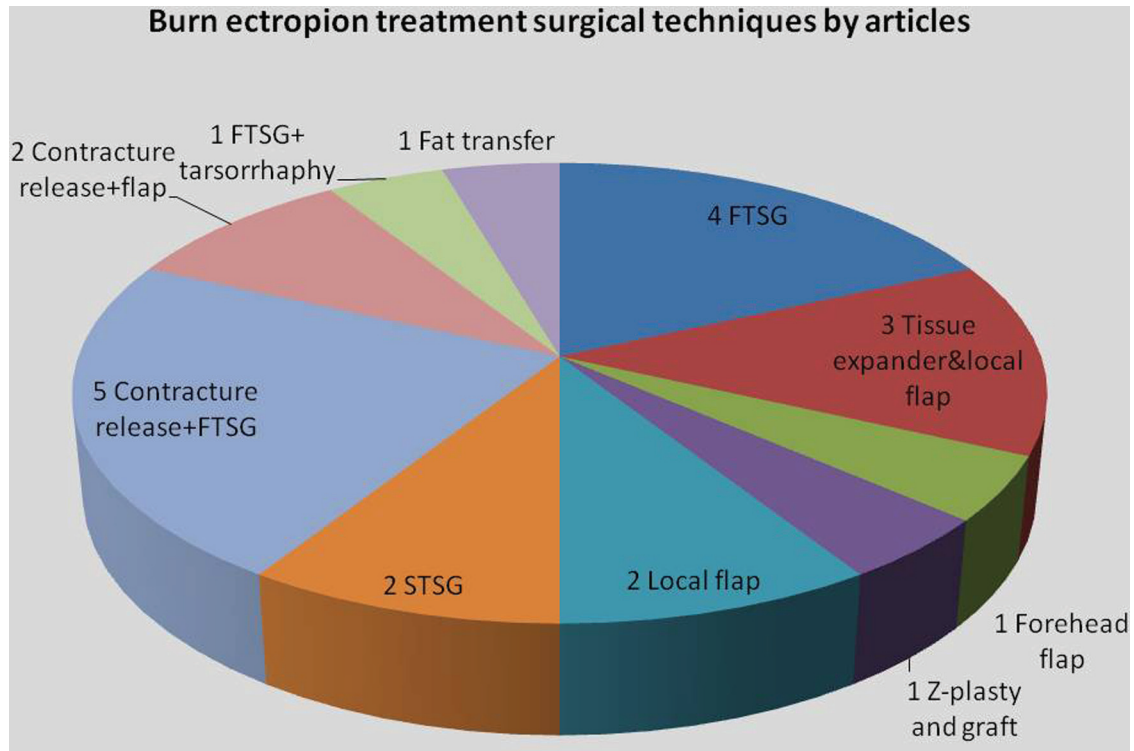
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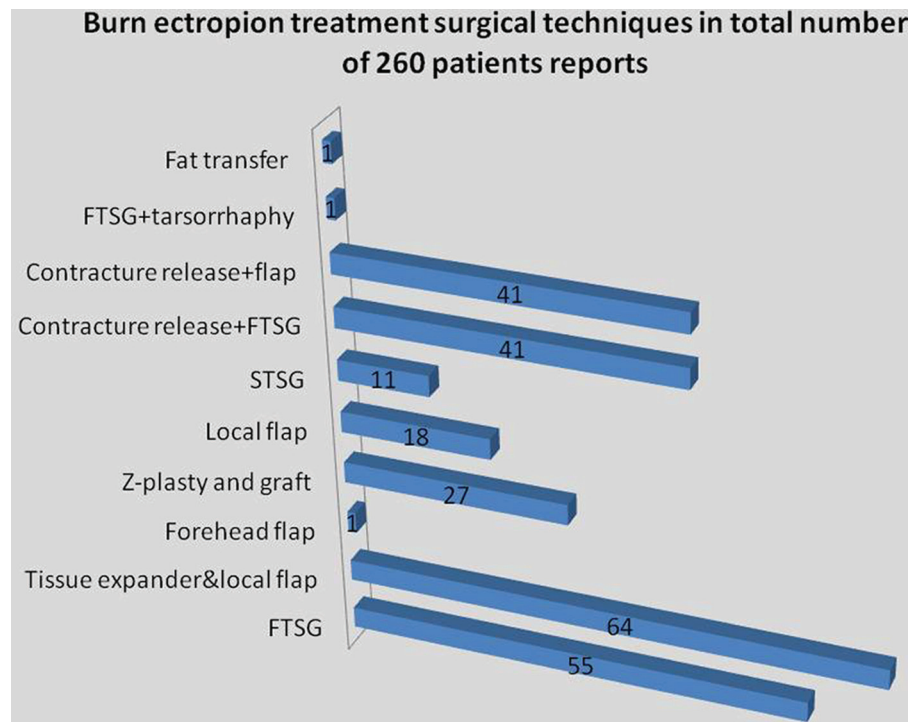
Table 1. (Continued)

Authors	Title/Objective	Year	Level of evidence	Patients (n)	Type of surgical treatment used	Results and suggestions
Zurada	[Surgical management of deep chemical burns of the eyelids]	2005	4	28	Contracture release, down to the orbicularis muscle, +/- distal part of the levator palpebrae superioris muscle. Full-thickness skin grafts	Satisfactory results. Early grafting of eyelid burns with full-thickness grafts, can prevent the development of recurrent cicatricial ectropion
Kostakoğlu et al.	Orbicularis oculi myocutaneous flap in reconstruction of postburn lower eyelid ectropion	1999	4	7	Laterally based orbicularis oculi myocutaneous flap from the upper eyelid	Satisfactory function and cosmesis were obtained in the evaluation of the patients up to 40 months of follow-up
Lille	Full-thickness grafting of acute eyelid burns should not be considered taboo	1999	4	18	10 patients received full-thickness skin grafts and 8 patients received split-thickness skin grafts	Three of 10 patients who received FTSG and 7 of 8 patients who received STSG developed ectropion and required reconstruction of the lids ( $P = 0.02$ )
Astori et al.	Cicatricial, postburn ectropion and exposure	1998	4	5	11 lower eyelid ectropion release with full thickness skin graft	Satisfactory results, only one patient needed repeat operation. All the patients were noted to have exposure keratitis on ophthalmological review
Small et al.	The tight retracted lower eyelid	1990	4	40	61 lower eyelids were repaired without a skin graft. In this technique, the retracted lower lid is repaired by releasing the lower eyelid retractors from their tarsal attachment. A lateral canthoplasty and lower lid prezygomatic flap anchored to the orbital periosteum support the released lower eyelid	Satisfactory results
Hurwitz et al.	Cicatricial ectropion due to essential skin shrinkage: treatment with rotational upper-lid pedicle flaps	1983	4	11	10 patients had pedicle skin flaps rotated from the upper lid to treat cicatricial ectropion. In an 11th patient there was insufficient redundant upper-lid skin, so a free skin graft was used instead	10 patients had an improved appearance, and epiphora persisted in only 1 patient, who subsequently underwent a punctum-enlarging procedure





**Chart 1.** Different techniques and their prevalence in the peer-reviewed literature.



**Chart 2.** Number of patients to have undergone treatment with each surgical technique.

lateral elevation, and has been documented as a procedure performed at the same time as definitive ectropion repair.<sup>22</sup>

A horizontally applied 1-inch wide tape used to splint the upper eyelid into a closed position has also been described.<sup>21</sup>

Surgical tarsorrhaphy, as opposed to the temporary suture technique Hollsten describes, has generated much controversy among both burn and ophthalmology surgeons,<sup>22</sup> mainly due to a feeling that it does not appear to prevent wound contraction where cicatricial ectropion is present, and so tissue replacement is indicated.<sup>23–25</sup>

## Perspectives

Facial burns pose a difficult problem for the burn surgeon, especially when the eyelids are directly or indirectly affected. Facial burns are a common injury nationally,<sup>26</sup> with visual loss being a relatively rare but devastating sequelae.<sup>27</sup> The eyelids and their reflexes are a highly evolved first-line protective mechanisms for the eye and can prevent initial damage to the eye and providing a window of opportunity for burns surgeons to intervene to ensure that secondary complications to the eye are prevented.

Lower eyelid ectropion is seen in deeper burns to the lower eyelids or to the malar or cheek areas where, as scarring develops, a progressive lagophthalmos with exposed cornea results in corneal injury.

The face is the main point of visual focus and attention during social interaction, and that its expression conveys conscious and unconscious emotions. Given that much of our communication to others is based on non-verbal cues that are primarily mediated by facial expressions, minimising the effects of burn scarring and sequelae in the peri-orbital region could help recovery and improve the quality of life outcomes of burn survivors. The ‘disfigured face syndrome’<sup>28</sup> has been used to describe patients’ loss of feelings of value and their role in life after a facial burn. The syndrome seems to be worse when the peri-orbital region is involved and for those burned while adolescents or young adults. Due to the complexity and poor cosmetic outcome of secondary reconstructive procedures around the eye, especially the causation of further facial asymmetry and scarring, primary prevention or mitigation of degree of ectropion is critical.

The optimal time to perform a skin graft on an eyelid for burn injury is still controversial, as is whether the graft should be split or full

thickness. Clinical priorities may mean burns elsewhere are treated first in a large burn. In addition, good blood supply, redundant eyelid skin and viable skin intermixed with deep burn may help avoid contracture in the first 2–3 weeks. The judicious use of dressings or allograft could also be of benefit. It appears that eyelid burn debridement is performed at a later time compared to other parts of the body. The timing of surgery is often dictated by the emergence of eyelid contracture or ectropion with tissue destruction having become demarcated, often at 2–3 weeks post injury.

Most surgeons seem to prefer proceeding to grafting as early as possible, but early grafting has been described to increase the risks of complications, particularly infection.<sup>2</sup> However, delayed skin grafting may increase the risk of hypertrophic scarring, asymmetry and other deformities of the eyelid that can lead to contractures and subsequent corneal exposure.<sup>7</sup>

## Technique summary

The surgical technique we have described is most useful as an early intervention when ectropion is or may be at risk of developing, and/or when the eyelids would benefit from stabilisation during and after skin graft application. The importance of ectropion prevention becomes clear from our review as delayed management still remains controversial therefore early intervention to preempt occurrence is valuable. Although we use both full thickness and split thickness skin grafts, our preference is the latter which provide excellent functional and cosmetic results as demonstrated in Figure 4, and due to the stability of the eyelid afforded by the described technique only skin glue or minor intervention is required to affix these grafts. We present this technique to the readership simply as a perspective. The potential for randomised clinical controlled trials in this arena is limited for a number of reasons and highlighted by our review of the literature.

## Conclusion

Our literature review of eyelid burns and methods of preventing and treating ectropion have revealed a small literature base with a diversity of strategies generally in the realms of case reports and case series. The need for well organised better designed studies with higher level of evidence could help standardise treatment and outcomes, but are unlikely to be forthcoming. We describe

our method of temporary lateral eyelid tarsorrhaphy with forehead hitch that can help to mitigate contraction forces on the lower eyelid during healing or scarring around the lower eyelid and cheek, especially in the context of facial burns or skin grafts. This does not completely obliterate vision. To achieve sufficient numbers of cases to undertake clinical trials or meaningful scientific data with the low volumes of diverse patients we treat is a pervasive dilemma, but not one that is likely to be solved. We necessarily rely on small case series sometimes as a starting point and we have demonstrated proof of concept, and signs of efficacy for a problem for which there are limited previously described prophylaxis or solutions.

### Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Ethical approval

The authors confirm that the necessary written, informed consent was obtained from patients for this article.

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