

## Case Report

# A multi-staged approach to the reconstruction of a burnt Asian face

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## ABSTRACT

This article describes the management of chemical burns to the Asian face with resultant full thickness loss to the right side of the face including the eyelid and nose. We detail the techniques used to reconstruct the face which include skin grafting according to the aesthetic units of the face, accurate placement of junction lines, use of a chondrocutaneous graft to reconstruct the alar groove and scalp strip grafting for eyebrow reconstruction. We obtained a successful result that minimised scar formation in the burnt Asian face.

## KEY WORDS

Alar-facial junction; chondrocutaneous grafts; eyebrow reconstruction

## INTRODUCTION

Asian faces tend to scar badly after burn injury and despite the best of efforts, results are not satisfactory. Compared with Caucasian patients, Asian burn wounds tend to scar much worse because of increased skin thickness and sebaceous gland activity. Chemical burns to the head and neck are recognised to be a particularly challenging category of burns.<sup>[1]</sup> We managed to obtain a good result in a case of acid burns of the face and we highlight the techniques used to overcome the challenges of managing the Asian burnt face.

## CASE REPORT

A 24-year-old male was injured with acid over his face and scalp. A single thorough wound debridement was performed involving sharp excision of burned skin down to dermis and fat [Figure 1]. At the orbicularis oculi, we excised down to muscle. Skin cover was planned as follows: the best skin was harvested for the most critical areas and injured areas were prioritised (in decreasing order of importance) as the eyelids, the nose, the cheeks, the preauricular area and the forehead.<sup>[2]</sup> For the eyelids, full thickness skin from the supraclavicular area was harvested. For the nose and cheek, skin was harvested from the scalp. Before harvesting, the scalp was infiltrated with 1L of saline to balloon up the scalp. This increased the surface area and allowed us to use the 4" air dermatome to obtain large sheet grafts. Hair that was stuck to the scalp grafts was removed to prevent it from acting as a foreign body. The donor scalp defect was secondarily grafted with meshed skin grafts to allow subsequent hair growth. For the forehead and preauricular area, skin from the thigh was used with acceptable skin match [Figure 2].

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**Figure 1:** Postdebridement - showing healthy granulation tissue prior to grafting

Before the grafts were applied, slow acting fibrin glue was sprayed giving us a short while to make minor adjustments to the graft position before the glue sets. Silk 6/0 sutures were used to stitch the graft at the junction lines of the aesthetic units. Quilting sutures were also used to secure graft position. The junction lines of the aesthetic units were precisely matched to minimise scarring and sutures bites were taken deeper to ensure that grafts were not resting on suture material. Skin graft overlap was not permitted.

After securing the graft, fenestrations were made in the graft to drain any collection [Figure 2]. Commonly, this is done before skin is laid on the wound bed but we made them after the skin was laid down to ensure that they did not violate tension lines. A 30° microknife was used for this purpose.

With excellent graft take, stitches were removed on the eighth postoperative day and the patient was discharged. At our patient's first year visit, he had a missing right eyebrow and half his anterior scalp was absent [Figure 3]. Two tissue expanders were inserted (500 and 700 ml) to restore hair-bearing scalp to the temporal and parietal areas [Figure 4]. Tissue expansion with two opposing expanders was used over a 6-month period. The tissue expanders were inserted through remote incisions to reduce the risk of wound dehiscence and scar stretch during expansion. The patient



**Figure 2:** Skin placement following the principles of aesthetic units. For the nose and cheek, skin was harvested from the scalp. For the forehead and preauricular area, thigh skin was used. Note that fenestrations were made along the relaxed tension lines

was advised to sleep upright and to avoid pressure on the expanders. At the time of expander removal and scalp flap inset, the galea was scored to allow us to cover the required area.

Our next stage involved hair transplantation to recreate the right eyebrow. A single-strip autograft was obtained from the inferior border of the hairline at the nape of his neck [Figure 5] taking care to match the orientation of the hair follicles by comparing with the unaffected eyebrow.

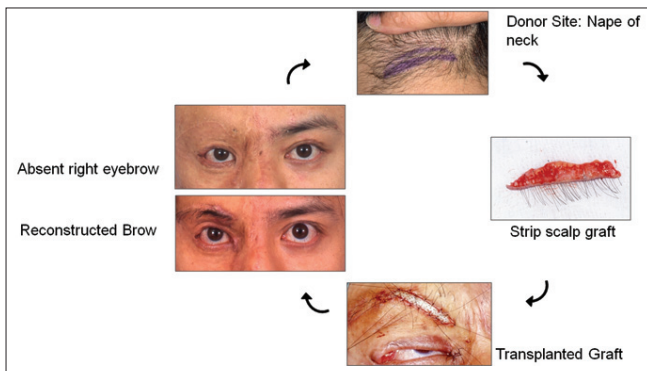
The right alar base was scarred down leading to obliteration of the alar-facial groove. A composite antihelical chondrocutaneous graft was harvested from the right ear to reconstruct the groove. The primary defect was closed with a conchal tranpositional flap. The secondary defect was covered with a skin graft [Figure 6].

## DISCUSSION

Despite the advances in burns management, we find that Asian skin is particularly prone to scarring and the cosmetic result is not satisfactory. Little has been published focusing on Asian facial burns. Hypertrophic and keloid scarring are more common in the Asian skin. The ratio of keloid or hypertrophic scarring in non-Whites compared to Whites



**Figure 3:** Appearance after 1st stage reconstruction showing missing right eyebrow and absence of anterior half of scalp



**Figure 5:** Showing the absent eyebrow, harvesting from the nape of the neck, placement of the graft and the final reconstructed brow

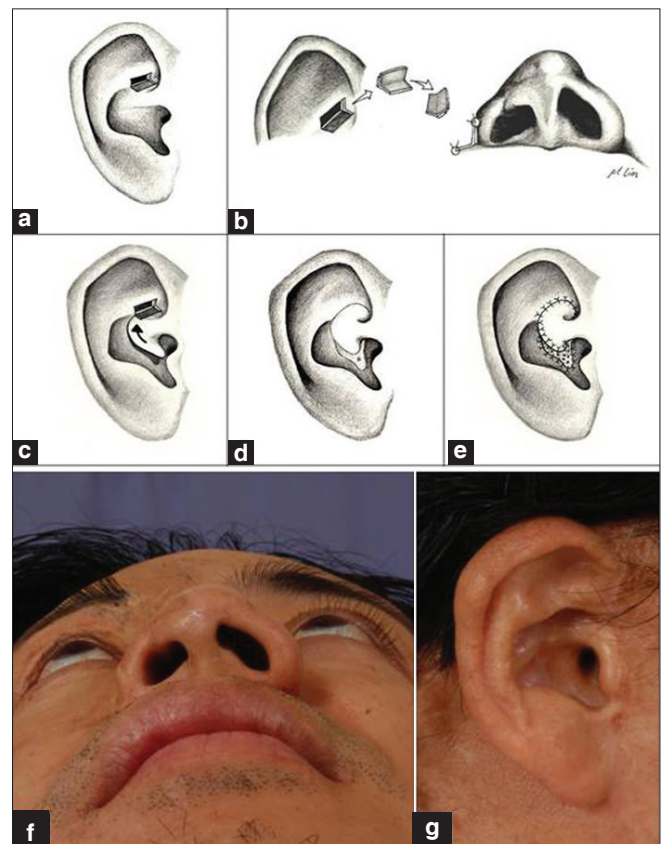
has been quoted to vary from 5:1 to 15:1.<sup>[3-5]</sup> Orientals have thicker, more seborrhoeic skin than Caucasians accounting for the higher incidence of keloid formation.<sup>[6]</sup> Hypo/hyperpigmentation also contributes to disfigurement.<sup>[7]</sup> It is more uncommon in Caucasians<sup>[8]</sup> but remains a challenging problem in Asians.

There are many factors resulting in hypertrophic or keloid scar formation. These include different anatomical regions, races, wound depths, injury types, genetic factors, prolonged immunological responses, infection and skin tension.<sup>[9]</sup> Most of these factors are innate factors that are difficult to control. We aim to control the last two factors.

Infection is best controlled by debridement of all devitalised tissue. Tangential excision is performed until punctuate bleeding is seen.<sup>[11]</sup> A suboptimal debridement leads to delay



**Figure 4:** Insertion of tissue expanders. The black line marks the hairline and the red line marks the superficial temporal artery



**Figure 6:** (a-e) Reconstruction of the right alar-facial groove. (a) Harvesting of composite antihelical chondrocutaneous graft; (b) Graft used to cover alar facial groove; (c) Conchal transposition flap used to cover donor site. Arrow shows direction of movement of flap; (d) After covering donor site with chondrocutaneous flap, a resultant secondary defect exists (marked with an asterix); (e) Secondary defect skin grafted. (f) the reconstructed alar-facial groove; and (g) The donor ear

in wound healing and eventual scarring. Infection prolongs the inflammatory process<sup>[10]</sup> resulting in the abnormal secretion of proinflammatory mediators. These mediators in turn cause abnormal fibroblasts responses<sup>[11]</sup> which can result in hypertrophic or keloid scarring.



**Figure 7:** Postoperative photos taken after 5 years

Grafting was not performed immediately after debridement to allow for the growth of healthy granulation tissue and to monitor for bleeding. The timing for grafting is critical - delayed skin grafting leads to excessive granulation tissue resulting in scarring. On the other hand, immediate grafting leads to inadequate granulation tissue and poor graft adherence. It is important, therefore, to obtain a balance in granulation tissue. In our case, we waited 5 days when there was healthy granulation tissue and no oozing or bleeding.

Skin tension is generated by violation of Langer's lines and anatomical landmarks. Scars are minimised by several aspects of our methodology. Firstly, the proper matching of aesthetic junction lines and the avoidance of graft overlap minimises scarring. Any scars that do form will be along junction lines and blend in with natural skin creases of aesthetic units. Secondly, we paid particular attention to our technique of fenestration. Fenestrations were made after the skin was laid down so that they follow the curvature of the underlying muscle. For instance, near the eye, the pattern of our fenestrations mimicked the circular shape of the orbicularis oculi muscle. This technique ensures that our fenestrations are individualised to the topographical region. Any resultant scar will blend in with natural tension lines.

It is important to free up all scar tissue and in our patient, the orbicularis oculi was stuck down and had to be completely freed. Inadequate freeing of the orbicularis oculi would have led to insufficient grafting and shortening of eyelids manifesting as lid retraction and ectropion. Movement of eyes during blinking and oral movement during mastication may lead to poor graft take. A Frost tarsorrhaphy was used for 5 days to prevent eyelid movement and a nasogastric tube was inserted to prevent chewing movements. The Frost tarsorrhaphy also kept the eyelid skin stretched and prevented the graft from contracting. Our patient was

advised not to talk or actively move his mouth for 1 week. The difficulty in immobilising the cheek and lips has been noted by other authors and they immediately applied splints and pressure dressings.<sup>[12]</sup> At the initial stages, we relied on our quilting sutures as a substitute for pressure dressing to aid in graft adherence to the wound bed. We feel that the application and removal of pressure devices may put unnecessary shearing forces on the delicate skin grafts and mask detection of any underlying hematoma.

Although skin grafting formed the mainstay of our skin reconstruction, Integra has been used as an alternative to grafting.<sup>[1]</sup> Integra is a synthetic bilayered composed of collagen and chondroitin. It is placed onto a full-thickness defect and invaded by fibroblasts. After 3-4 weeks, integra is replaced by a dermal matrix. On this layer of dermis, a thin "epidermal" graft is placed. We find that this process takes a long time and is best used for patients with shortage of native skin.

Postburn scalp alopecia has been classified according to the extent and density of hair loss.<sup>[13]</sup> Our patient would be classified as a Type 1A with a single alopecic segment and less than 25% of hair bearing scalp lost. To reconstruct this alopecic patch, tissue expansion was used. We recommend starting tissue expansion at least 6 months after all wounds have healed. By 6 months, the full extent of scarring can be assessed and a suitably sized expander can be used.<sup>[14]</sup> In our case, we used two expanders to cover the alopecic patch with satisfactory results. In some instances, tissue expansion has also been used to replace facial skin as the thinner expanded skin can provide a "near perfect" match to facial skin.<sup>[15]</sup>

Our maintenance therapy included pressure garments at one month and silicone sheeting to prevent hypertrophic scarring. Our patient was very compliant with treatment and persevered with pressure garments despite local heat and humidity. He slept upright when the tissue expanders were inserted. He also had regular had massage therapy for his scars and grafted skin. His sleeping position was helpful in reducing swelling and improving lymphatic drainage. The 5-year result is shown [Figure 7].

Our next aim was to reconstruct the right eyebrow and the right alar base. Our patient's eyebrow was not thick and a strip graft was adequate. The superficial temporal artery flap has been described before but there are problems with the extensive dissection and donor site alopecia.<sup>[16]</sup> A more recently described option is the subcutaneous pedicle island

flap<sup>[17]</sup> which carries the risk of injuring the frontal branch of the facial nerve. We did not perform either flap as the donor scalp was burnt.

With regards to the nose, retraction of the alar margin is common and requires replacement of both cover and lining.

<sup>[1]</sup> Reconstruction was performed with a composite antihelical chondrocutaneous graft to provide cartilaginous support.

We managed to obtain good results due to both patient and technical factors. The Asian patient's thick skin predisposes him to hypertrophic and keloid scar formation. With our technical factors, we aim to try and mitigate this.

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