available at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/burns

Case report

# Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis☆

Andrew J. Lindford [a,*], Ilkka S. Kaartinen [a], Susanna Virolainen [b], Jyrki Vuola [a]

[a] Department of Plastic Surgery, Helsinki University Hospital, Helsinki, Finland
[b] Department of Pathology, Haartman Institute, Helsinki University Hospital, Helsinki, Finland

ARTICLE INFO

*Article history:*
Accepted 19 July 2011

## 1. Introduction

Toxic epidermal necrolysis (TEN) is a rare potentially life-threatening drug-induced skin disorder resulting in extensive mucocutaneous exfoliation and systemic involvement. TEN is now generally considered to result from a disregulated immune reaction against epithelial cells. TEN was first described by Alan Lyell [1] and is therefore commonly referred to as Lyell's disease or syndrome. It is closely related to Stevens–Johnson syndrome (SJS) and both conditions are considered to be caused by the same disease process. SJS is often defined by less than 10% epidermal loss and TEN more than 30% loss with those in between classified as SJS-TEN. Clinically they present with an acute macular erythematous rash with bullae which can rapidly progress to extensive areas of epidermal separation and shedding. A positive Nikolsky's sign (slight rubbing of the skin resulting in exfoliation of the outermost layer) is characteristic [2]. The SCORTEN severity of illness scoring system helps to predict mortality in TEN patients [3]. Due to often extensive areas of epidermal involvement with resultant water, electrolyte and protein losses it is generally agreed that these patients should be admitted early to a Burn Unit [1].

At present there are no standard management guidelines but treatment should be multidisciplinary with prompt diagnosis, withdrawal of the suspected drug, supportive care and wound management. Many specific pharmacological therapies are cited in the literature but a general consensus and evidence base is lacking. However topical wound care is an integral part of the overall management of this condition. The areas of epidermal loss can be compared to the wound of a partial-thickness burn and thus many different wound dressings are available. At present there is no general agreement as to what is the most efficacious and appropriate wound care material.

Suprathel® (PMI Polymedics Innovations GmbH, Germany) is a recently introduced epidermal substitute. It is composed of a synthetic co-polymer of polylactide, trimethylene carbonate, and ε-caprolactone and has been used in partial-thickness burns as well as in split-thickness skin graft donor sites. It is reported to reduce pain in both burn and donor site wounds and also to reduce exudation of donor sites compared to a conventional open method [4,5]. There are two reports of the use of Suprathel® in Staphylococcal scalded skin syndrome [6] and TEN in a young infant [7].

Allograft (cadaveric) skin however is well recognised for its use in TEN as well as its versatility in burn patients in general [8–10].

We report our experience in the use of Suprathel and allograft skin in a severe case of TEN.

## 2. Case report

A 17 year-old female with a history of depression was admitted to the General Medical Intensive Care Unit with a diagnosis of TEN with blistering and epidermal separation affecting 80% of the total body surface area (TBSA). Two and a half weeks prior to this she had commenced lamotrigine medication for a new diagnosis of bipolar disorder. At

☆ Attributed to: Helsinki Burn Centre, Department of Plastic Surgery, Helsinki University Hospital, Helsinki, Finland.
* *Corresponding author at*: Helsinki Burn Centre, Töölö Hospital, PO Box 266, FI-0029 HUS Helsinki, Finland.
E-mail address: andrew.lindford@hus.fi (A.J. Lindford).

doi:10.1016/j.burns.2011.07.015

presentation she was pyrexial and had a SCORTEN score of 2 (associated with an expected mortality of 12.2% [3]). She was transferred to our Burn Unit on day 2 with symmetrical exfoliation affected both arms circumferentially from wrists to shoulders, trunk circumferentially, face, neck and scalp, perineum and both lower limbs circumferentially from ankles to groins. Clinically these lesions demonstrated Nikolsky's sign (Fig. 1). There was sparing of the feet, hands, buttocks and partial sparing in the flexures. There was also moderate ophthalmological involvement with purulent conjunctivitis and pseudomembrane formation as well as involvement of the oropharyngeal mucosa. Intravenous fluid resuscitation was initiated with commencement of nasogastric feeding and adequate opioid analgesia. Low-molecular weight heparin antithrombotic prophylaxis was also commenced.

On day 3 under GA in theatre the affected areas were debrided using a scrubbing brush, scissors and forceps. The debrided areas were then cleansed with saline. Suprathel® was applied to the entire right arm, right leg and trunk circumferentially (Fig. 2). The Suprathel® was then covered with paraffin gauze and dry dressings. Non-meshed allograft skin from our skin bank (glycerolised skin) was also applied to the entire left upper limb, left lower limb and facial area. The allograft skin was attached with staples and covered similarly with paraffin gauze and dry dressings [9] (Fig. 3). A 4 mm punch biopsy was also taken from the right thigh. An ophthalmologist attended to the eyes.

Following debridement the patient remained intubated due to pain from the affected oral mucosa. She received a three day course of intravenous immunoglobulins as well as a short course of steroids. Intravenous antibiotics (meropenem) were commenced on day 6 due to pyrexia and raised inflammatory markers. Within a few days however her condition stabilised; she became apyrexial with decreasing inflammatory markers and was extubated on day 9. The punch biopsy confirmed TEN with a clear loss of epidermis at the epidermodermal junction (Fig. 4). There was no positive microbiology from cultures taken from wound swabs.

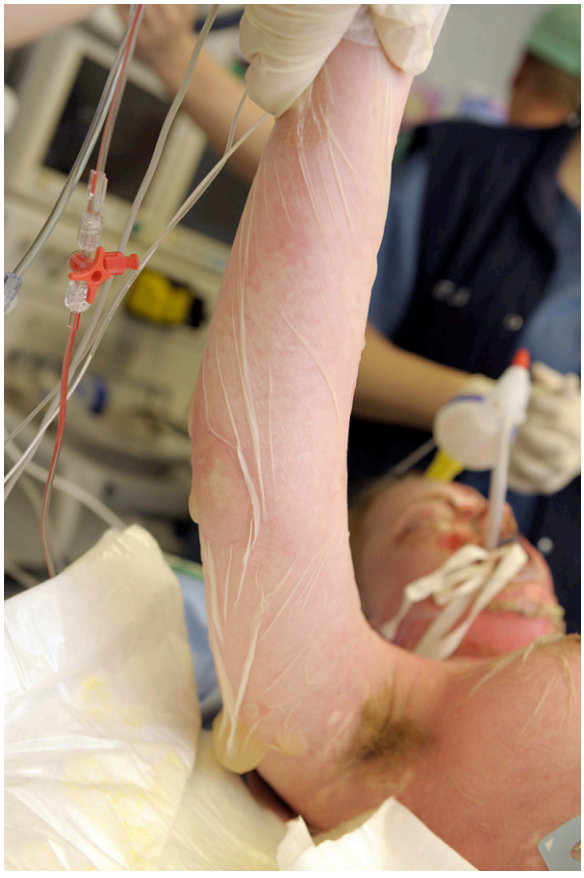

**Fig. 1 – Positive Nikolsky's sign in the right upper limb at the time of initial debridement.**

Dressings were inspected daily for any signs of underlying infection.

The left upper and lower limbs covered with allograft skin exudated more and required changing of the overlying gauze every few days. The Suprathel®-treated regions on the other

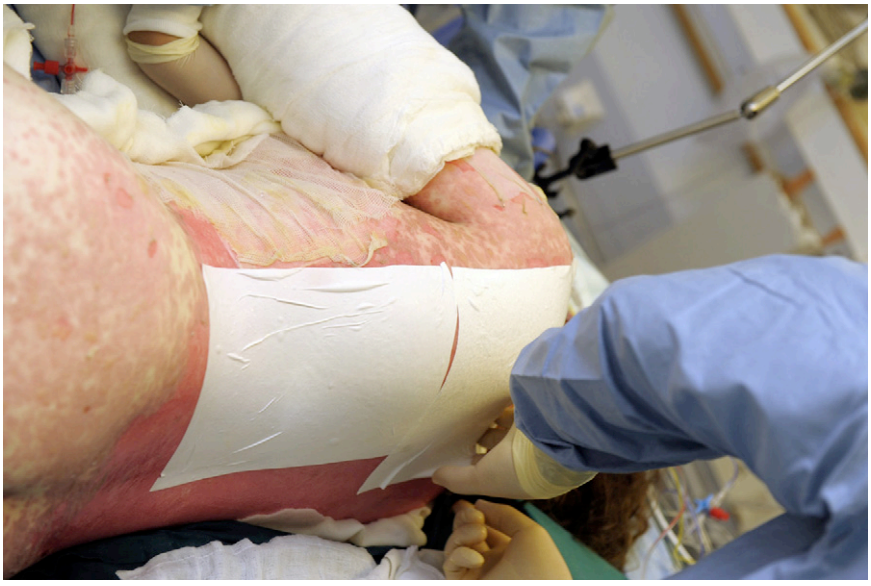

**Fig. 2 – Application of Suprathel®.**

Please cite this article in press as: Lindford AJ, et al. Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis. Burns (2011), doi:10.1016/j.burns.2011.07.015

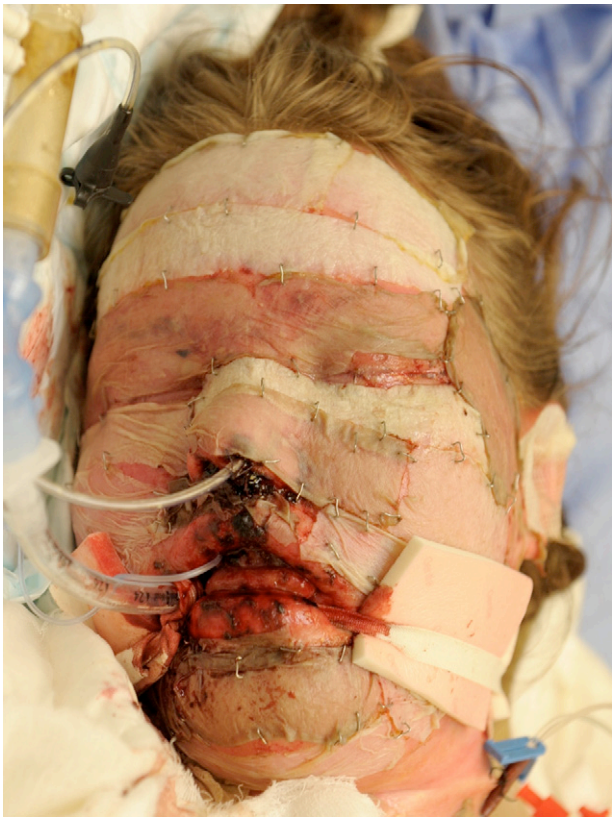

**Fig. 3 – Allograft skin applied to the facial area.**

hand required no dressing changes and were left totally intact. During this time the patient reported no pain at all from the Suprathel®-areas but pain on movement of the allograft-treated limbs.

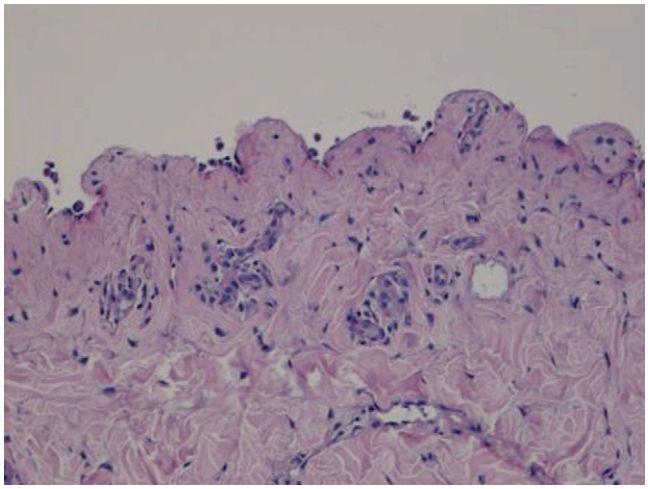

**Fig. 4 – Acute TEN with separation of necrotic epidermis from dermis at epidermodermal junction.**

After 12 days all dressings were removed in theatre under GA. The Suprathel®-treated areas had nearly completely (~95%) re-epithelialised (Fig. 5). As regard to the allograft-treated areas, the allograft skin had taken well but there were obvious unhealed areas and large areas of firmly embedded allograft requiring further wound care (Fig. 6). 4 mm punch biopsies were taken from the well-healed Suprathel®-treated right upper thigh and from the allograft-treated left arm. Histology revealed in the Suprathel®-treated area normally healed skin with epithelial hyperplasia (Fig. 7). Histology of the allograft-treated area also demonstrated normally healed skin (epithelial hyperplasia) beneath the allograft skin but with one clear difference; the allograft-healed skin lacked the epidermal granular layer (Fig. 8).

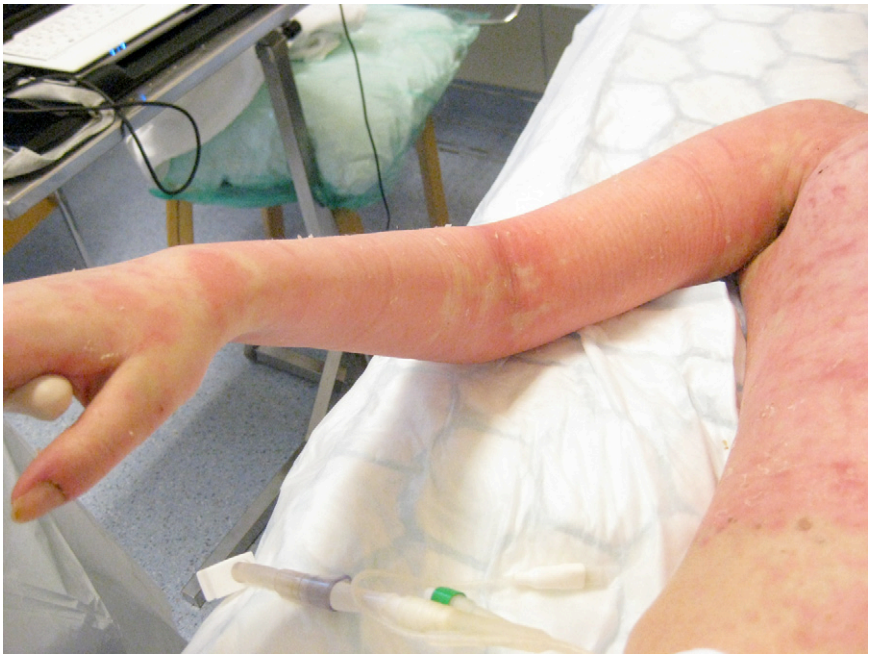

**Fig. 5 – Well healed right arm on day 12 after removal of Suprathel® dressings.**

Please cite this article in press as: Lindford AJ, et al. Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis. Burns (2011), doi:10.1016/j.burns.2011.07.015

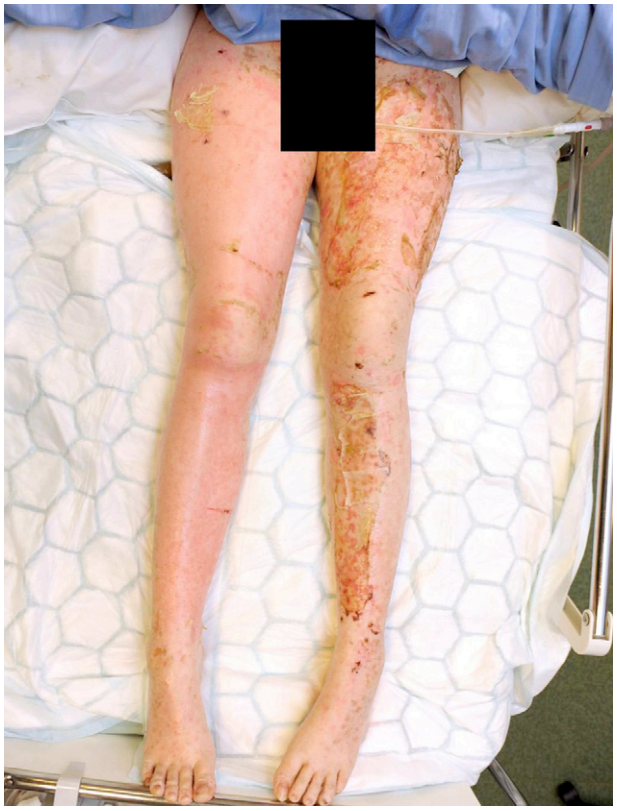

**Fig. 6 – Suprathel®-treated right lower limb and allograft-treated left lower limb at day 12.**

All Suprathel® areas were completely healed at 3 weeks and no longer required dressings. There were significant areas of firmly adherent allograft remnant in the allograft-treated limbs and facial area thus requiring further wound care. These areas of allograft remnants were left intact (Fig. 9). She was discharged after 4 weeks but required follow-up with the ophthalmologists for blocked lacrimal drainage due to formation of synechiae.

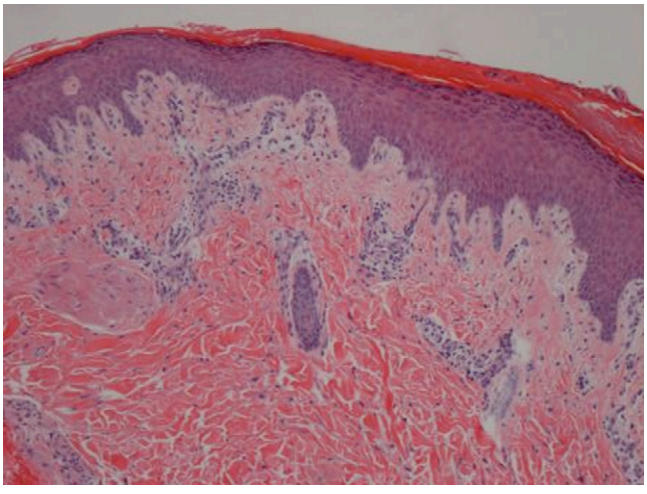

**Fig. 7 – Normal Suprathel®-healed skin with epithelial hyperplasia at 12 days.**

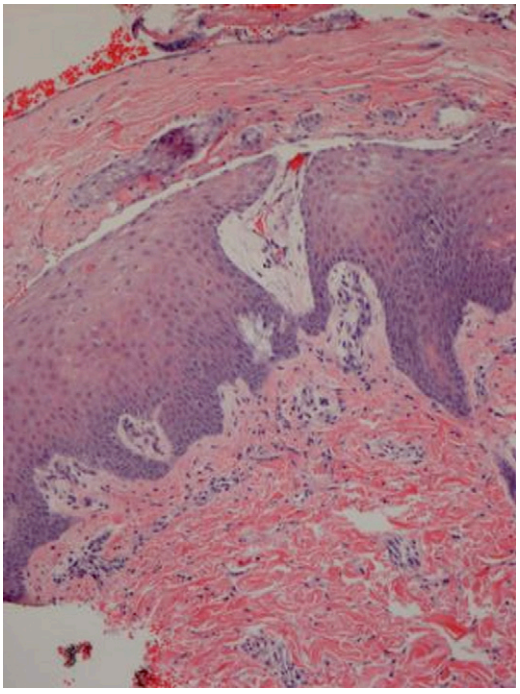

**Fig. 8 – Allograft skin overlying otherwise normally healed skin but absent epidermal granular layer at 12 days.**

## 3. Discussion

Treatment of TEN is essentially supportive with immediate cessation of the possible causative medication and management of the patient in a burn unit. In this case the assumed trigger was the initiation of lamotrigine treatment 2 weeks earlier, an antiepileptic drug (AED) that is also used in the treatment of bipolar disorder. Lamotrigine was discontinued immediately by her GP after the onset of blistering 3 days prior to presentation to the acute medical services with rapidly worsening symptoms. The precise role of steroids, immunosuppressants and/or immunoglobulins remains unclear [2]. Wound care however forms a key part in the management of the patient. Following debridement the exposed dermis needs to be protected with some form of coverage to facilitate epithelialisation and prevent infection.

A temporary skin substitute provides temporary wound coverage to provide an optimal milieu for epithelialisation and prevent infection. Properties of an ideal temporary skin substitute include: good adherence, moisture permeability, infection control, comfortable, physical adaptability, transparency, non-toxic, long shelf-life, easy availability, durable, cost-effective, and ease of application.

Suprathel® (PolyMedics Innovations, Filderstadt, Germany) is a synthetic resorbable temporary epidermal skin substitute that satisfies many of the above criteria. It is a copolymer predominantly based on DL-lactide and caprolactone. We have been using Suprathel® in recent years for most superficial partial thickness paediatric burns and have found the reduction in pain, reduced number of dressing changes and 'apparent' improved wound healing to be its chief virtues [11].

Please cite this article in press as: Lindford AJ, et al. Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis. Burns (2011), doi:10.1016/j.burns.2011.07.015

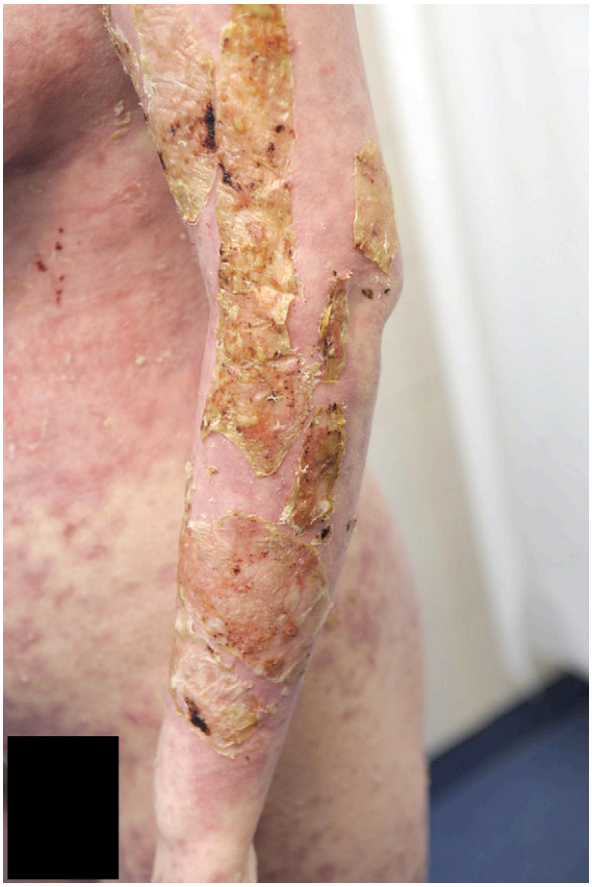

**Fig. 9 – Allograft remnant still firmly attached to left upper limb at three weeks.**

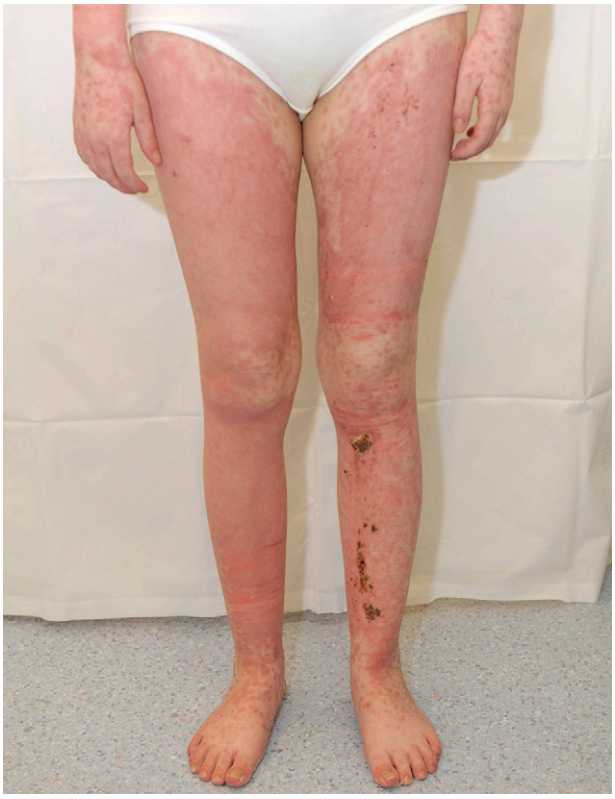

**Fig. 10 – The cosmetic appearance at four weeks showing markedly better outcome in the Suprathel® treated right lower limb.**

We also use Suprathel® for donor sites in burn patients predicted to have problematic healing e.g. in elderly patients.

In this case of TEN Suprathel® was much easier to apply than the allograft skin; the paper-like material easily adhered and 'moulded' to the wound surface and did not require any fixing. The allograft skin however required staples and was more cumbersome and time-consuming to apply owing to the smaller pieces (average ~5 cm × 10 cm) and tendency for the edges to roll inwards. There was significantly reduced exudation with the Suprathel®-treated areas which led to fewer dressing changes and less pain in contrast to the allograft. The Suprathel®-treated areas healed overall much quicker (<12 days) than the allograft areas (14–21 days). The overall cosmetic appearance of the Suprathel®-healed epithelium was superior to the allograft healed skin (Fig. 10). It is possible that the lack of the epidermal granular layer in the allograft-healed skin could negatively impact on final epidermal maturation (Fig. 8). In addition the facial areas treated with allograft had significant areas of firmly embedded allograft remnant which may require dermabrasion later on.

In general Suprathel® can be used straight off the shelf and has a long shelf life. Although we have our own skin bank many burn centres do not have such easy access to allograft skin [9].

The cost of Suprathel® is potentially a deterrent when considering the coverage of particularly large wounds but is however cheaper than our allograft skin (0.5 euros/cm$^2$ vs 0.81 euros/cm$^2$, respectively). The fewer number of dressing changes needed and shorter healing time may be compensatory factors in the cost equation.

Suprathel® has also been reported to have superior antisepsis in vitro to Acticoat® (Smith and Nephew, UK) and Aquacel Ag® (ConvaTec Inc., USA) which is a characteristic useful in the potentially large wound areas of TEN [12].

In spite of our positive experience with Suprathel® we still use allograft skin from our skin bank in many burn cases as well as for other non-burn indications including earlier cases of TEN treated in our unit. Allograft still remains a versatile and reliable temporary skin substitute [9] and is certainly not a bad option in TEN. All areas treated with allograft had indeed largely healed within 3 weeks but in some areas the deeper dermal remnant of the allograft skin had become embedded in the healing epidermis requiring further wound care.

Although our use of Suprathel® in TEN is limited to this one case, we feel that our comparative findings are significant due to the large symmetrical areas of uniform wound depths consistent with the nature of the disease process. At the very least we feel confident in concluding that Suprathel® appears to be superior to allograft skin in TEN.

AEDs such as lamotrigine are well recognised potential triggers of TEN syndrome or SJS. Although the overall risk in AED users is regarded as low, it appears to be highest in new users during the first two months of treatment with an estimated risk of 1–10 cases per 10,000 new users [13].

Please cite this article in press as: Lindford AJ, et al. Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis. Burns (2011), doi:10.1016/j.burns.2011.07.015

Education of doctors prescribing AEDs should thus be encouraged regarding the possibility of this potentially life-threatening condition.

In conclusion wound coverage using Suprathel® in TEN compares favourably with conventional use of allograft skin. Suprathel® enables easier application, less exudation with fewer dressing changes, reduced pain and earlier re-epithelialisation. Histological analysis reveals a lack of the epidermal granular layer in the allograft-healed skin.

## Conflict of interest statement

The authors declare that they have no financial nor other relationship to the manufacturer of the described dressing.

## REFERENCES

[1] Lyell A. Toxic epidermal necrolysis: an eruption resembling scalding of the skin. Br J Dermatol 1956;68(November (11)):355–61.
[2] Lissia M, Mulas P, Bulla A, Rubino C. Toxic epidermal necrolysis (Lyell's disease). Burns 2010;36(March (2)):152–63.
[3] Bastuji-Garin S, Fouchard N, Bertocchi M, Roujeau JC, Revuz J, Wolkenstein P. SCORTEN: a severity-of-illness score for toxic epidermal necrolysis. J Invest Dermatol 2000;115(August (2)):149–53.
[4] Schwarze H, Küntscher M, Uhlig C, Hierlemann H, Prantl L, Ottomann C, et al. Suprathel, a new skin substitute, in the management of partial-thickness burn wounds: results of a clinical study. Ann Plast Surg 2008;60(February (2)):181–5 [Erratum in: Ann Plast Surg 2008 Apr;60(4):415].
[5] Schwarze H, Küntscher M, Uhlig C, Hierlemann H, Prantl L, Noack N, et al. Suprathel, a new skin substitute, in the management of donor sites of split-thickness skin grafts: results of a clinical study. Burns 2007;33(November (7)):850–4 [Epub 2007 May 9].
[6] Mueller E, Haim M, Petnehazy T, Acham-Roschitz B, Trop M. An innovative local treatment for staphylococcal scalded skin syndrome. Eur J Clin Microbiol Infect Dis 2010;29(July (7)):893–7.
[7] Pfurtscheller K, Zobel G, Roedl S, Trop M. Use of Suprathel dressing in a young infant with TEN. Pediatr Dermatol 2008;25(September–October (5)):541–3.
[8] Pianigiani E, Ierardi F, Taddeucci P, Perotti R, Biagioli M, Di Simplicio FC, et al. Skin allograft in the treatment of toxic epidermal necrolysis (TEN). Dermatol Surg 2002;28(December (12)):1173–6.
[9] Vuola J, Pipping D. Maintaining a glycerolized skin bank – a practical approach. Burns 2002;28(October Suppl. (1)):S31–3.
[10] Spies M, Sanford AP, Aili Low JF, Wolf SE, Herndon DN. Treatment of extensive toxic epidermal necrolysis in children. Pediatrics 2001;108(November (5)):1162–8.
[11] Kukko H, Kosola S, Pyörälä S, Vuola J. Suprathel® in treatment of children's scald injuries. Burns 2009;35(September):S22.
[12] Ryssel H, Germann G, Riedel K, Reichenberger M, Hellmich S, Kloeters O. Suprathel–acetic acid matrix versus acticoat and aquacel as an antiseptic dressing: an in vitro study. Ann Plast Surg 2010;65(October (4)):391–5.
[13] Mockenhaupt M, Messenheimer J, Tennis P, Schlingmann J. Risk of Stevens–Johnson syndrome and toxic epidermal necrolysis in new users of antiepileptics. Neurology 2005;64(April (7)):1134–8.

Please cite this article in press as: Lindford AJ, et al. Comparison of Suprathel® and allograft skin in the treatment of a severe case of toxic epidermal necrolysis. Burns (2011), doi:10.1016/j.burns.2011.07.015