

Keystone Design Sliding Skin Flap for the Management of Small Full Thickness Burns

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تصميم سديلة جلدية انزلاقية في علاج الحروق الصغيرة كاملة السُمك

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المخلص: يكون علاج الحروق الجلدية العميقة والحروق كاملة السُمك بصفة عامة بالاستئصال والترقيع برقعة جلدية رقيقة. قد تعطي الرقعة الجلدية لونا غير مقبول، ولهذا تكون غير مقبولة من الناحية التجميلية. كما قد تسبب أيضا عيباً في محيط الرقعة، كما يمكن أن تنتج عنها درجات مختلفة من التققع. إن تصميم السديلة الانزلاقية التي وصفت لأول مرة عام 2003 تلغي الحاجة إلى الترقيع الجلدي، ولا يصاحبها أي من مشاكل الرقعة الجلدية. ندرج هنا تقريراً عن حالتين تم استخدام هذه السديلة فيهما كجراحة أولية لترميم حروق صغيرة كاملة السُمك. مفنح الكلمات: حروق، ترقيع الجلد، سديلة، تقرير حالة، عُمان.

ABSTRACT: Deep dermal burns and full thickness burns are generally managed by excision and split thickness skin grafting. The skin graft may lead to unacceptable colour changes and be aesthetically unacceptable. Also, there may be a contour defect and, furthermore, it is followed by varying degrees of contracture. The keystone design sliding flap, first described in 2003, avoids the need for grafting and is not associated with any skin graft problems. We report two cases of the use of this flap as the primary surgery in reconstruction of small full thickness burn defects.

Keywords: Burns; Skin grafting; Keystone flap; Case report; Oman

DEEP DERMAL BURNS AND FULL thickness burns are generally managed by excision and split thickness skin grafting. The skin graft has certain disadvantages. It may lead to unacceptable colour changes in certain skin types and be aesthetically unacceptable. Also, there may be a contour defect and, furthermore, the graft is followed by varying degrees of contracture.

The keystone design perforator island flap was first described by Behan in 2003.¹ Since then, there have been number of articles on this flap. Most of them reported its use to cover defects created after the excision of malignant lesions.^{2,3,4} We have used this flap to cover defects resulting from full thickness burns as the primary surgery instead of skin grafting. The use of this flap in certain areas like hands has a superior aesthetic result in term of colour and contour compared with a skin graft. In addition, contracture formation is reduced.

The keystone sliding skin flap is made in the following manner. The defect is converted to an elliptical defect. A curvilinear incision is made parallel to the defect with two incisions at a 90 degree angle at either end of the defect which meet the curvilinear line. This results in a keystone design flap. The width of the flap is equal to the width of the defect. The length of the flap is determined by the size of the excisional defect. Careful teasing of the circumferential tissues is performed without any flap undermining so as to preserve the integrity of perforators.¹

We report here two cases with defects resulting from excision of full thickness burns which were covered with a keystone design sliding skin flap.

Case One

A 28 year-old male sustained an accidental full thickness electrical burn of his hypothernar

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Figure 1: Case One - (A) The defect with marking for keystone flap; (B) After closure with keystone flap; (C) The appearance one day postoperative.

eminence [Figure 1]. He underwent excision of the full thickness burnt skin. As the defect was small (about 1.5 x 1.5cm) and it was on the hand, a keystone design sliding skin flap was mobilised to cover the defect. The postoperative course was uneventful. On follow-up, the flap was settling well and the aesthetic result was good.

Case Two

A 19 year-old male sustained electrical burns when he was holding an iron rod which touched an electric wire [Figure 2]. He had full thickness burns over the anteromedial aspect of his right forearm (about 2 x 4 cm in size) with ulnar nerve palsy. The patient was referred for surgery where the distal forearm burns were excised. The ulnar nerve was explored and found to be oedematous and was decompressed in the Guyon's canal. The defect was covered with a keystone design sliding skin flap. On subsequent follow-up, the keystone flap was settling

well and the aesthetic result was good. The ulnar nerve completely recovered.

Discussion

The keystone design sliding skin flap is very useful as it is easy and fast to raise. It minimises or abolishes the use of skin grafting and gives a better contour. Also it can be raised in areas where other flaps are difficult to raise. The skin graft in Omani patients (Fitzpatrick scale Types IV, V and VI)⁵ invariably becomes hyperpigmented and aesthetically unacceptable, especially if used on hands [Figure 3]. Furthermore, as skin grafts may result in contour defects and contractures, we started using the keystone design sliding skin flap cover as the primary surgery to cover the small full thickness burns after excision.

The two cases described above had defects on the hand. Covering these defects with a keystone flap resulted in a normal contour and normal skin



Figure 2: Case Two - (A) Full thickness burns; (B) Defect after debridement; (C) Planning of the flap; (D) After closure of the defect; (E) After 6 days; (F) After 3 months.



Figure 3: Example of hyperpigmented skin graft.

colour which would not be possible with a skin graft. In both of the cases, it was easy to raise the flap. There was no flap loss and there were no complications.

In both of the cases, we used a Type I keystone flap. The keystone flap has been classified by Behan into four types: Type I: The keystone flap is a skin island based on subcutaneous perforators. The lateral deep fascia margin may be left intact; Type II: Division of the deep fascia along the outer curvilinear line to obtain adequate advancement of the flap and facilitate closure. The donor site is either primarily closed [type IIA] or skin grafted [type IIB] if undue tension exists; Type III: This is used for larger defects, two identical opposing keystone flaps are mobilised; Type IV: up to 50% of the flap can be undermined subfascially to maintain the perforator support in order to facilitate its rotation.^{1,6}

The flap is sensate which gives it an advantage over the skin graft. It has a dual blood supply from the superficial vascular network and the perforators.⁶ Also it was found that vascular perfusion is augmented in the keystone flaps. This phenomenon is still unexplained. One of the possible explanations is that as the sympathetic nerve is divided, catecholamines are released from the nerve terminal.⁷ As a result the keystone flap is very reliable.

In reconstructive surgery, aesthetic appearance is not given much attention as the priority is to provide tissue cover, but the deformity always has

a psychological impact on the patient. Combining reconstructive surgery with an aesthetic approach when treating a tissue defect improves the final result and reduces the negative psychological impact.

Conclusion

The use of the keystone flap Type I for small full thickness burn defects results in normal colour and contour. It avoids the use of grafts that invariably become hyperpigmented and aesthetically unacceptable. The flap is sensate and this is a great advantage over the skin graft. Another advantage over the graft is that there is no contracture formation.

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