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# Early experience with fat grafting as an adjunct for secondary burn reconstruction in the hand: Technique, hand function assessment and aesthetic outcomes<sup>☆</sup>



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## ARTICLE INFO

### Article history:

Received 17 November 2014

Received in revised form

27 April 2015

Accepted 26 June 2015

### Keywords:

Hand

Burn

Fat grafting

Lipofilling

Function

Aesthetic

## ABSTRACT

**Introduction:** Fat transfer is increasingly used as part of our reconstructive armamentarium to address the challenges encountered in secondary burn reconstruction. The aim of this study was to review our experience with autologous fat transfer in relation to hand function, scarring and cosmesis, in patients undergoing secondary reconstruction after burns.

**Method:** Retrospective analysis of burn patients (2010–2013) who underwent autologous fat transfer to improve scarring, contour deformity and/or scar contracture was performed. Hand function was assessed using grip strength measurement, Total Active Movement (TAM), the Disabilities of the Arm, Shoulder and Hand (DASH) Questionnaire and Michigan Hand Outcome Questionnaire (MHQ). Patients' satisfaction was assessed using the Patient Observer Scar Assessment Scale (POSAS).

**Results:** Thirteen patients were included in this analysis. The average time from burns and from fat transfer were 2.3 years (10 months–3.9 years) and 9.1 months (3 months–1.3 years), respectively. There was a statistically significant improvement in TAM measurement. The total score, activity of daily living score and satisfaction score of the MHQ also statistically increased following fat transfer. The changes in function score, work score and pain score of the MHQ were not significant. Grip strength measurement and DASH score did not show improvement. For scar assessment, total score and overall score of POSAS improved significantly. Similarly, scores for scar colour, scar thickness, scar stiffness and scar regularity increased significantly.

**Discussion:** Autologous fat transfer directly replaces volume loss in the subcutaneous layer, physically releases tethered skin from underlying tissues and exerts downstream regenerative effects. Skin quality improvements combined with replacement of the subcutaneous

<sup>☆</sup> Presented in part in a paper entitled "Early experience with lipofilling for burns scar contracture" by M. Byrne at the joint Winter Scientific Meeting of British Association of Plastic, Reconstructive and Aesthetic Surgeons and Irish Association of Plastic Surgeons on the 27–29th November 2013 at the Dublin Convention Centre.

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<http://dx.doi.org/10.1016/j.burns.2015.06.017>

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adipose volume in the hand reduces overall scar tightness and tissue tethering and has the potential to enhance hand therapy. In our series, modest improvement in range of movement, scar quality and hand outcome scores were demonstrated following a single session of fat transfer.

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## 1. Introduction

Burn scars often present a particular reconstructive challenge from both a functional and cosmetic perspective. The physical limitation can be due to deficient or altered anatomy or contracture resulting in hyperextension of the metacarpophalangeal joint with visible claw or boutonniere deformity, first web space contracture or a syndactyly due to skin migration – all which are functionally impairing.

Reference to human fat transfer dates as far back as 1601, and though reviled by many as an unwanted appendage, Dutch surgeons employed this ‘sovereignest’ remedy for treating wounds and diseases after the Siege of Ostend. Later in 1893, Gustav Adolf Neuber, performed the first free fat autograft, to treat a soft tissue depression in the malar region, with autogenous abdominal fat [1]. Two years later, Vincenz Czerney, published on his use of adipose tissue for symmetrisation of a breast following tumour excision, a practice increasingly used today [2].

Lipofilling has since been used in a multiplicity of areas, including breast reconstruction/contour defect augmentation, and correction of asymmetries associated with hemifacial microsomia. Its use in the hand extends to softening hypertrophic scars following both congenital and trauma surgery, and for skin rejuvenation in the cosmetic setting. There is however, a distinct scarcity of published series on outcomes, after autologous fat grafting for hypertrophic, keloid or abnormally fibroplastic scars resulting from burns. Klinger et al. [3] report from their histologic and clinical findings of three patients with burn scars.

The National Burns Unit in Ireland assesses 200 clinically significant burns per annum, necessitating admission for surgical and medical management. With ever increasing patient survival, greater numbers of burns patients are presenting for secondary reconstruction, to enhance cosmetic appearance and improve clinical function of scarred, contracted areas, with the aim of bettering overall quality of life.

Fat grafting has been used at our unit, to address some of the challenges encountered at secondary reconstruction. This paper aims to review our early experience in a small cohort of patients with burns to their hand. They underwent autologous fat transfer to address function, scarring and cosmesis following their primary burns debridement and grafting. We hypothesised that autologous fat grafting could potentially improve hand function and range of motion, cosmetic appearance and patient satisfaction following treatment.

## 2. Methods

### 2.1. Design

This is a retrospective study of prospectively collected data on patients who sustained a flame or scald burns between 2010 and 2013 and subsequently underwent autologous fat transfer for resultant scarring, contour deformity, and/or contracture. Patients were considered when they had maximise potential of their rehabilitation as determined by the senior occupational therapist and Burns consultant surgeon.

Inclusion criteria consisted of patients with:

1. Decreased range of motion due to scar contracture
2. Cosmetically displeasing scars

Exclusion criteria comprised patients with:

1. Joint capsule tightness/joint stiffness as main cause of decreased range of motion
2. Poor Compliance

### 2.2. Assessment of patients' hand function

Pre-operative assessment was carried out by the senior specialist occupational therapist and included:

*Total Active Movement (TAM)* as assessed by the stainless steel Goniometer. Each digit was measured as a unit in terms of total flexion and extension. To obtain the TAM for a finger the total motion of all three joints into flexion was added together minus the extension deficit. According to the American Society for Surgery of the Hand (ASSH) system, a TAM value of 260° is Normal (MCP = 85°, PIP = 110°, DIP = 65°): 260° is Excellent, 196–259° is Good, 131–195° is Fair and <130° is Poor.

*Grip Strength Measurement* was assessed using the Jamar Dynamometer, with the second grip setting employed. The average score, based on three static grip strengths was recorded.

*The Disabilities of the Arm, Shoulder and Hand (DASH) outcome measure*, which is a 30-item, self-report questionnaire designed to measure physical function and symptoms in people with upper limb conditions was administered to all patients [4].

*Michigan Hand Outcome Questionnaire (MHQ)*, which is a hand specific outcomes instrument, measuring the health outcomes of patients with chronic hand conditions was also completed [5].

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