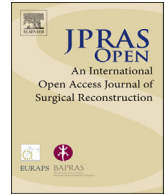




Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

JPRAS Open

journal homepage: <http://www.journals.elsevier.com/jpras-open>



## Deliberate self-harm scars: Review of the current literature

Weiguang Ho <sup>a</sup>, Christopher David Jones <sup>b,\*</sup>, William Anderson <sup>b</sup>

<sup>a</sup> Department of Plastic Surgery, Ulster Hospital, Belfast, UK

<sup>b</sup> Department of Plastic, Burns and Reconstructive Surgery, St John's Hospital, Livingston, EH54 6PP, UK

### ARTICLE INFO

#### Article history:

Received 16 November 2017

Accepted 5 March 2018

Available online 9 April 2018

#### Keywords:

Scar

Cicatrix

Deliberate self-harm

Wound surgery

### ABSTRACT

**Introduction:** Deliberate self-harm (DSH) can be defined as self-inflicted injury without suicidal intent. Treatment of DSH scars may involve a lengthy process and is not commonly treated in its initial stages to allow scar maturation. This review aims to assess the challenges behind scar treatment and outcomes of different surgical methods used to resurface DSH scars.

**Methods:** A review of the literature using CENTRAL, Cochrane, Medline and Embase from January 1990 to February 2016 was conducted. Our search strategy incorporated a combination of MeSH terms “Deliberate self-harm scars” and “self-inflicted scars”. Relevant bibliographies of literature were manually reviewed for additional resources. Non-English studies, non-human studies and studies prior to 1990 were excluded.

**Results:** A variety of techniques were described with including excision and full thickness skin graft reconstruction, excision with Integra resurfacing followed by split-thickness skin graft reconstruction, multiple excisions and laser therapy. A detailed summary of these findings is outlined. All studies reviewed show improved cosmetic outcome in treatment of DSH scars to some degree and no studies reported repeated self-harm.

**Discussion:** The literature surrounding the treatment of DSH scars is limited. There is a lack of use of reproducible and standardized scoring systems to compare between studies. The psychology behind DSH and their resultant scars adds another dimension of complexity beyond simple scar reconstruction.

<sup>1</sup> Post-publication corresponding author.

\* Corresponding author. Department of Plastics, Burns & Reconstructive Surgery, St John's Hospital, Livingston, EH54 6PP, UK.

E-mail address: [cdj9lfc@gmail.com](mailto:cdj9lfc@gmail.com) (C.D. Jones).

<https://doi.org/10.1016/j.jpra.2018.03.001>

2352-5878/© 2018 Published by Elsevier Ltd on behalf of British Association of Plastic, Reconstructive and Aesthetic Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

*Conclusion:* When considering treatment, patient expectations must be carefully evaluated. Research in this area is lacking but understandable due to the nature of the self-harm.

© 2018 Published by Elsevier Ltd on behalf of British Association of Plastic, Reconstructive and Aesthetic Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Deliberate self-harm (DSH) can be defined as self-inflicted injury without suicidal intent.<sup>1,2</sup> Various methods of DSH have been described in the existing literature, with self-initiated cutting behaviour and substance misuse being identified as the most common modalities.<sup>3</sup>

In recent decades, the rates of DSH have increased worldwide<sup>4</sup> and, notably, DSH has been found to be most prevalent amongst female adolescents.<sup>1,4–6</sup> It is well documented that patients suffering from depression and anxiety due to a traumatic experience (such as physical or sexual abuse) are more likely to self-inflict injuries,<sup>6</sup> as the act of DSH is believed to confer upon the individual a sense of relief from a “terrible state of mind” and suffering.<sup>7</sup>

Following self-inflicted injuries, patients are often left with scars. Scar treatment may involve a lengthy process and is not commonly treated in its initial stages to allow scar maturation.<sup>8</sup> Depending on the nature and surface area of the scar, different treatment options exist, which include steroid injections, silicone gel therapy, surgical revision, laser therapy and camouflage.<sup>3</sup> However, given that DSH scars are often flat, multiple and linear, responses to steroid injections are often less than satisfactory.<sup>9</sup> These features also make surgical revision challenging.<sup>3</sup>

Several techniques have been devised as temporary measures to hide the scar or reduce its prominence using camouflage make up and silicone gels respectively.<sup>10</sup> These methods primarily address symptomatic features of DSH scars (e.g. itch and erythema) but are only temporary measures and do not address the cosmetic appearance of the scar.<sup>10</sup>

This review aims to assess the psychological challenges behind and decisions to treated DSH laceration scars, along with outcomes of different surgical methods used to resurface DSH scars.

## Methods

A systematic search of all relevant articles published on Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews (CDSR), Medline, Embase from January 1990 to February 2016 was conducted. This search was limited to publications in English. Our search strategy incorporated a combination of terms “Deliberate self-harm scars” and “self-inflicted scars” and included all publications on DSH laceration scars. In addition, relevant bibliographies of literature were manually reviewed for additional resources. The literature search was repeated by the first and senior authors. Exclusion criteria included non-English studies, non-human studies and studies prior to 1990.

A total of 79 publications was found. After applying the relevant inclusion and exclusion criteria, five case studies and series were selected for review. Information on patient demographics, scar revision techniques, outcomes and repeat DSH were collected from each study.

## Results and Discussion

### *Deliberate self-harm scars and the patient*

Scars from DSH can vary from lacerations most commonly found on the flexor aspect of the non-dominant forearm or wrist to burn scars on the face. There is a wide variety of options available for treatment of scars, and can be implemented for symptomatic or complicated scars, or for aesthetic

reasons. However, scars from DSH add another dimension to the patient and decisions to treat due to its complex psychological nature. As these scars were self-inflicted as opposed to inflicted by others or as a result of an accident, the psychological, and at times, sociological aspects of these scars play a role on how the patient and others close to them view their scars. Dermatitis artefacta or factitial dermatitis generally refers to denial of the self-inflicted nature of the cutaneous injury.<sup>1</sup>

DSH can be inflicted for a variety of reasons. Clinicians most commonly associate DSH with impulsive behaviour, which is sometimes under the influence of depression. In reality, DSH is multi-dimensional, multi-factorial and complex. For instance, a young person, riddled with problems with relationships with family and friends, or poor performance at school could resort to DSH with the intention of committing suicide, as a form of “release”. An elderly person with dementia or Parkinson’s disease may commit DSH due to depression. Self-mutilation, as part of a dysmorphophobic spectrum in a patient, may be because of a distorted view of him or herself. Alternatively, an actively psychotic patient may attempt DSH due to a delusion or thought disorder. There is no denying that the motives behind DSH are still not entirely well-understood and management often requires multidisciplinary input.

Welch et al described a detailed perspective of self-harmers, their reasons for DSH, the emotions attached to these scars, and the stigma and humiliation society attaches to them. They further concluded that the scars were not about symbols, but were a cry for help.<sup>2</sup> Elmore and Frank, in their reply, stated that Welch et al’s conclusions were skewed because those patients had successfully overcome earlier trauma to function competently in social, marital and highly responsible professional roles, indicating healthy ego function. They argue that surgery could become a pattern self-mutilating behaviour, with potentially medicolegal consequences, as those who have not overcome their abuse and its sequelae could draw an unwary surgeon into a relationship that re-enacts their earlier trauma and victimization.<sup>3</sup> Barton and Dickson, in their case report, suggested that instead of “cry for help” or “coping mechanism”, patients may now have beneficial “reasons” for self-harming.<sup>4</sup>

Barton and Dickson described an unusual case of a single patient with paranoid schizophrenia who attempted auto-scar revision surgery for self-harm scars inflicted 9 years earlier, after watching a documentary on satellite television about scar-revision surgery. Subsequently, he practised suturing on 1 cm incision in pre-existing scars, used topical lidocaine gel, cut ellipses with razor blade, sutured with household needle and cotton. Consequently, he presented with 3 infected wounds which were treated with dressings and psychiatry follow-up and he was determined to not be psychotic.<sup>4</sup>

#### *To treat or not to treat?*

The treatment of DSH scars is complicated by the nature of the psychosocial factors contributing to DSH insult. The ideal outcome for treatment of DSH scars would be an aesthetically improved appearance with no recurrent self-harm post treatment that might damage reconstructive work.

One of the barriers to safe and successful treatment of scars from DSH is the underlying psychology or psychiatric illness leading to the initial and repeated self-harm. Patients may inflict harm onto themselves repeatedly due to a known or undiagnosed psychiatric problem. These need to be overcome or assessed to be in remission prior to scar revision. Elmore and Frank describe that patients who have not overcome their abuse and its sequelae could draw an unwary surgeon into a relationship that symbolically re-enacts their earlier trauma and victimization. They state that in such an instance, surgery could become part of a pattern of self-mutilating behaviour, with potentially medicolegal consequences.<sup>3</sup>

Levenkron explains that active self-mutilators may have a fear of “completely healing up”. This can be a major pitfall as many of them reopen nearly healed wounds or continually create new wounds.<sup>5</sup>

Scars in general have major influence on patients’ psychological morbidity and behaviour in 5 main areas: physical comfort and functioning; acceptability to self and others; social functioning; confidence in the nature and management of their condition; and emotional well-being.<sup>6</sup> Welch et al describes further that patients with scars from DSH adapt physically and emotionally to stigma, shame, guilt and anger to both how they are perceived by society and how they perceive themselves.<sup>2</sup> As such, treatment of such scars, even if the cosmetic outcome is objectively worse than before, can improve the psychology, self-confidence, and self-esteem of the patients.<sup>7</sup> Even in patients with no further self-harm

episodes, insight into the cause of the scar or discontent with the scar is important in the treatment of such scars. Whitaker and Smith described 2 cases where scar revision was unsuitable due to the patients' lack of insight into the cause of their scars.<sup>1</sup> Both patients highly denied having inflicted these scars even through accidental means, hence they could be at risk of causing recurrence or poor healing of these scars once treated.<sup>1</sup>

As a result, many physicians recommend a psychiatric consultation if disease is self-induced. Whitaker and Smith argue that some patients refuse this and adhere to their belief that the problem is entirely physical due to lack of insight.<sup>1</sup> Fruensgaard suggested that patients with self-induced disease may benefit from psychotherapeutic program if they are compliant with this mode of treatment.<sup>8</sup>

Gherardini, who reported a case of a self-inflicted vibrator burn after suction-assisted lipectomy, recommends that unusual behaviours and unusual requests should be considered as bells of danger, and the patient should be asked to return for a further consultation or invited not to proceed to surgery.<sup>9</sup>

Whitaker and Smith recommended that cosmetic revision of DSH scars should not be undertaken unless the patient meets the following criteria<sup>11</sup>:

1. prolonged period of remission (at least 2 years) without re-injury;
2. expressed desire for behaviour modification; and
3. insight regarding the cause achieved through a therapeutic relationship.

On the contrary, Zahl and Hawton, in a study of 11,583 patients, found that 61% of patients did not repeat self-harm following treatment.<sup>10</sup> Acikel et al observed that camouflage of a socially unacceptable scar improves the psychology, self-confidence, and self-esteem of the patients and motivates them to take more active and productive roles in their social and business lives. They further to describe the ideal candidate to be a young adult with normal psychology who had an episodic act of self-mutilation in the past.<sup>7</sup>

Setting treatment goals can be a challenging task. Treatment of DSH scars, like that of cosmetic procedures, is based on the expectations of patients and the modalities available to achieve this. The expectations of patients with DSH however may be more difficult due to the individual perceptions and desires, its social acceptability and potential personal consequences of bearing these scars. Welch et al claimed that there is no way the aesthetic outcome can objectively be improved by surgical intervention, but patient satisfaction may be improved.<sup>2</sup> Levenkron concurs with Welch et al's findings with respect to breast and rhino surgery, but advised caution with active self-mutilators because of their fear of "completely healing up", with tendency to reopen nearly healed wounds or continually create new wounds, and as such, recommended a thorough skin examination to determine time elapsed since the last wound.<sup>5</sup>

### *Treatment options*

The literature surrounding the treatment of DSH scars is limited.

Welch et al, in his case series of three patients with previous DSH seeking revision of scars, outlined eight treatment options for such scars<sup>12</sup>:

1. Conservative and long sleeves, makeup, ace wraps
2. Elliptical excision of forearm skin and closure, in single procedure or serially
3. Tissue expansion with subsequent excision
4. Dermabrasion
5. Tattoo camouflage or overtattoo
6. Tangential excision of involved area with reapplication of the excised tissue at 90 degrees
7. Tangential excision of the involved area and application of a split-thickness graft from a remote site
8. Full-thickness excision of the involved area and application of a split-thickness skin graft harvested from a remote site

They outlined successful treatment for their patients with DSH scars in volar surfaces of forearms with full-thickness excision of the involved area and application of a split-thickness skin graft.<sup>2</sup>

Lee et al used carbon dioxide lasers with the pinhole method in the treatment of DSH scars in the forearm, wrists and hands and found marked improvement both objectively (73%) and subjectively (68%).<sup>11</sup>

Acikel et al also successfully used carbon dioxide laser resurfacing but with the addition of thin skin grafting method as effective in camouflaging method in three patients with self-inflicted razor blade incision scars.<sup>7</sup> In their study, 88% of observers were unable to identify the previous DSH scars and all patients were satisfied.

Papanastasiou reported the harvesting of split-thickness skin graft from the scarred skin and re-application of the graft after turning it 90 degrees.<sup>12</sup> Although there was no assessment of subjective outcomes, the authors report “overall more socially acceptable appearance” in all patients at 12 months.

Welch et al reported full-thickness excision of the involved area and application of a split-thickness skin graft in the treatment of four patients.<sup>2</sup> Ismail et al described the use of full-thickness excision, Integra (Integra Life Sciences, Plainsboro, NJ, USA) grafting, vacuum-assisted wound closure (VAC<sup>®</sup>) dressing, subsequent removal of Integra and split skin grafting.<sup>13</sup> In both papers, no subjective or objective assessments were made of the resurfaced scars.

Full-thickness excision, Integra and sheet split-thickness skin grafting (SSG), and VAC dressing were used by Todd et al in six cases. They reported no objective resemblance to DSH scars despite areas of pigmentary change. All patients were satisfied and infection was reported in one case.<sup>14</sup>

### *Integra*

Burke et al introduced the dermal regeneration template, Integra, in 1981. Integra is a bilaminar membrane system consisting of porous bovine tendon collagen and shark glycosaminoglycan (chondroitin-6-sulfate) covered by a temporary epidermal substitute made of silicone.<sup>15</sup>

Integra has a wide evidence base for reconstruction of burn defects, notably because of its advantages of being immediately available in large quantities, the simplicity and reliability of technique, and the pliability and the cosmetic appearance of the resulting cover.<sup>15–22</sup>

Dantzer and Braye outlined a case series of 31 patients in whom Integra grafting was undertaken in the same operation as initial removal of burn scar tissue or tumour excision on a total of 39 sites.<sup>23</sup>

Moiemen et al undertook a two-year clinical and histological analysis of Integra dermal regeneration template in 14 patients case series and found significant improvement in range of movement, softness, appearance, sensation, dryness and itch, and detailed their histological findings of abnormally arranged collagen and elastic fibrin, nerve fibres limited to middle or lower reticular dermis, and no residual template matrix observed.<sup>24</sup>

In the UK, Integra is commonly used for a variety of procedures. It is the mainstay of reconstruction for DSH scars in the Plastic Surgery unit of NHS Lothian based in St. John Hospital, Livingston.

To date, the evidence for the use of Integra in scar revision is limited. Ismail et al described 2 cases of previous DSH scars using Integra with high levels of satisfaction and no repeat in self-harm behaviour.<sup>13</sup>

### *Standardized scoring systems*

Perhaps the greatest limitation in the studies listed in [Table 1](#) is the lack of the application of an objective or comparable measure of cosmetic outcome. Consequently, comparisons between methods of treatment of DSH scars cannot be objectively made due to this limitation.

The Vancouver Scar Scale (VSS) was originally proposed by Sullivan et al in 1990 as a method of subjective assessment of burn scars by healthcare professionals.<sup>25</sup> It has become one of the most commonly utilized scales for scar assessment in clinical research owing to its value in evaluating scars of a wide range of aetiologies. There are four broad areas assessed in VSS—vascularity, pigmentation, pliability and height—with scores in each area amounting to a maximum of 13. The major disadvantage in VSS is that patient-reported evaluation of the scar is not considered.

The newer Patient and Observer Scar Assessment Scale (POSAS) overcomes this by including clinician and patient perspectives of the scar. It has similar areas of with additional consideration of patients'

**Table 1**

A summary of three published case reports and a case series on surgical management of DSH scars.

Reference	Anatomical sites (n)	Technique	Average follow up (months)	Outcome measures	Outcome	Repeated self-harm
Papanastasiou et al (1995) <sup>12</sup>	5 forearms	SSG and reapplication at 90 degrees rotation	12	1. Objective cosmesis	1. "Overall more socially acceptable appearance" in all patients	–
Welch et al (1999) <sup>2</sup>	3 volar forearms	Full thickness excision and SSG	–	–	–	None
Acikel et al (2005) <sup>7</sup>	26 anatomical sites (11 upper arms, 11 forearms, 4 anterior chest) in 16 patients	Carbon dioxide laser, followed by thin skin grafting	12	1. Objective cosmesis 2. Subjective cosmesis	1. 88% of observers did not recognise the scars as DSH 2. All satisfied	6.3%
Ismail et al (2008) <sup>13</sup>	2 forearms	Full-thickness excision, Integra <sup>†</sup> grafting, VAC dressing, then removal of Integra and SSG	18*	–	–	None
Todd et al (2012) <sup>14</sup>	5 forearms, 1 arm	Full-thickness excision, Integra grafting and sheet SSG, VAC dressing	4	1. Objective cosmesis 2. Subjective cosmesis 3. Infections	1. No resemblance to DSH scars, variation in degree of pigmentation observed 2. All patients satisfied 3. 1 of 6 patients had an infection	–
Lee et al (2016) <sup>11</sup>	4 forearms, 5 wrists, 1 wrist and forearm, 1 wrist and hand	Carbon dioxide laser (pin hole method)	3	1. Objective cosmesis 2. Subjective cosmesis 3. Adverse events	1. 73% marked or near total improvement 2. 64% satisfied or very satisfied 64% satisfied or very satisfied 3. 18% post-inflammatory hyperpigmentation	–

SSG = Split-thickness skin grafting.

\* In only first case, no follow up disclosed for second case.

† Integra dermal matrix (Integra Life Sciences, Plainsboro, NJ, USA).

perception of pain, itching, colour, stiffness, thickness and relief.<sup>26</sup> Both VSS and POSAS, however, lack consideration into the functional outcome of the evaluated symptoms and scar qualities. Other subjective scar assessment scales include the Manchester Scar Scale and the Stony Brook Scar Evaluation Scale.<sup>27</sup>

## Conclusion

The psychology behind DSH and their resultant scars adds another dimension of complexity beyond simple scar reconstruction. The symbolism of the scar and reason driving scar revision may be positive or further “enable” self-harm behaviour. As such, the general consensus leans towards a careful approach with psychological assessments prior to offering treatment.

If considering treatment, patient expectations must be carefully evaluated. All studies reviewed fail to show improved cosmetic outcome in treatment of DSH scars.

Research in this area is lacking but understandable due to the nature of the self-harm.

## Conflict of interest

None.

## Funding

None.

## References

- Whitaker DC, Smith AC. A caution in the evaluation of scar revision. *J Am Acad Dermatol*. 1993;28(2 pt 1):269–270.
- Welch JD, Meriwether K, Trautman R. Stigmata: part I. Shame, guilt, and anger. *Plast Reconstr Surg*. 1999;104:65–71.
- Elmore J, Frank RE. Approach scar revisions after self-inflicted wounds with caution. *Plast Reconstr Surg*. 2000;105:1240–1241.
- Barton CR, Dickson WA. Surgery by satellite: a new generation of self-harmers. *Br J Plast Surg*. 2002;55:702–703.
- Levenkron S. Stigmata: part I. *Plast Reconstr Surg*. 2000;105:1240, author reply 1240–1.
- Brown BC, McKenna SP, Siddhi K, McGrouther DA, Bayat A. The hidden cost of skin scars: quality of life after skin scarring. *J Plast Reconstr Aesthetic Surg*. 2008;61:1049–1058.
- Acikel C, Ergun O, Ulkur E, Servet E, Celikoz B. Camouflage of self-inflicted razor blade incision scars with carbon dioxide laser resurfacing and thin skin grafting. *Plast Reconstr Surg*. 2005;116:798–804.
- Fruensgaard K. Psychotherapy and neurotic excoriations. *Int J Dermatol*. 1991;30:262–265.
- Gherardini G. An unusual complication after suction-assisted lipectomy and poor patient selection. *Plast Reconstr Surg*. 2005;115:664–665.
- Zahl DL, Hawton K. Repetition of deliberate self-harm and subsequent suicide risk: long-term follow-up study of 11,583 patients. *Br J Psychiatry*. 2004;185:70–75.
- Lee SJ, No YA, Kang JM, et al. Treatment of hesitation marks on the forearm by the pinhole method. *Lasers Med Sci*. 2016;31:1339–1342.
- Papanastasiou S. Treatment for self-inflicted laceration scars. *Plast Reconstr Surg*. 1995;96:1754.
- Ismail A, Jarvi K, Canal ACE. Successful resurfacing of scars from previous deliberate self-harm using Integra dermal matrix substitute. *J Plast Reconstr Aesthetic Surg*. 2008;61:839–841.
- Todd J, Ud-Din S, Bayat A. Extensive self-harm scarring: successful treatment with simultaneous use of a single layer skin substitute and split-thickness skin graft. *Eplasty*. 2012;12:e23.
- Burke JF, Yannas I V, Quinby WC, Bondoc CC, Jung WK. Successful use of a physiologically acceptable artificial skin in the treatment of extensive burn injury. *Ann Surg*. 1981;194:413–428.
- Moiemen NS, Staiano JJ, Ojeh NO, Thway Y, Frame JD. Reconstructive surgery with a dermal regeneration template: clinical and histologic study. *Plast Reconstr Surg*. 2001;108:93–103.
- Frame JD, Still J, Lakhel-LeCoadou A, et al. Use of dermal regeneration template in contracture release procedures: a multicenter evaluation. *Plast Reconstr Surg*. 2004;113:1330–1338.
- van Zuijlen PP, Vloemans JF, van Trier AJ, et al. Dermal substitution in acute burns and reconstructive surgery: a subjective and objective long-term follow-up. *Plast Reconstr Surg*. 2001;108:1938–1946.
- Branski LK, Herndon DN, Pereira C, et al. Longitudinal assessment of Integra in primary burn management: a randomized pediatric clinical trial. *Crit Care Med*. 2007;35:2615–2623.
- Palao R, Gómez P, Huguet P. Burned breast reconstructive surgery with Integra dermal regeneration template. *Br J Plast Surg*. 2003;56:252–259.
- Boyce ST, Kagan RJ, Meyer NA, Yakuboff KP, Warden GD. The 1999 clinical research award. Cultured skin substitutes combined with Integra Artificial Skin to replace native skin autograft and allograft for the closure of excised full-thickness burns. *J Burn Care Rehabil*. 1999;20:453–461.
- Muangman P, Deubner H, Honari S, et al. Correlation of clinical outcome of Integra application with microbiologic and pathological biopsies. *J Trauma Inj Infect Crit Care*. 2006;61:1212–1217.

23. Dantzer E, Braye FM. Reconstructive surgery using an artificial dermis (Integra): results with 39 grafts. *Br J Plast Surg*. 2001;54:659–664.
24. Moiemien N, Yarrow J, Hodgson E, et al. Long-term clinical and histological analysis of Integra dermal regeneration template. *Plast Reconstr Surg*. 2011;127:1149–1154.
25. Sullivan T, Smith J, Kermode J, McIver E, Courtemanche DJ. Rating the burn scar. *J Burn Care Rehabil*. 1990;11:256–260.
26. Draaijers LJ, Tempelman FRH, Botman YAM, et al. The patient and observer scar assessment scale: a reliable and feasible tool for scar evaluation. *Plast Reconstr Surg*. 2004;113:1960–1965.
27. Fearmonti R, Bond J, Erdmann D, Levinson H. A review of scar scales and scar measuring devices. *Eplasty*. 2010;10:e43.