Review Article

Split thickness skin graft compression: a scoping review

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Background: Split thickness skin graft (STSG) is a routine reconstructive manoeuvre, particularly after excision of cutaneous lower limb malignancies. While surgical technique is well established, evidence supporting the postoperative management of these grafts is less robust. Compression therapy after the index procedure may be an important adjunct for graft take and minimizing complications, particularly in patients susceptible to oedema from a concurrent lymph node procedure.

Methods: An initial PubMed literature search was performed using the terms "split thickness skin graft", "compression" and "oedema" yielding no results, hence a broader search was performed combining the terms "compression", "pressure" and "split thickness skin graft" providing 383 results. One hundred articles remained for abstract review after an initial screen.

Results: The literature on compression therapy to promote split thickness graft take is modest, with only 12 articles described (12/100, 12.0%). Even then, none of these were in the setting of grafting after oncological resection. Many of the articles promote negative pressure wound therapy (NPWT) as an established adjunct to promote graft take (80/100, 80.0%).

Conclusions: There is limited demonstrated efficacy of postoperative compression therapy for lower limb STSG let alone in patients with an ancillary lymph node procedure. Further large-scale trials ideally in a prospective fashion are warranted to validate this as a simple, widely available and cost-effective adjunct to STSG in this particularly susceptible population of reconstructive patients.

Keywords: Split thickness skin graft (STSG); vacuum assisted closure (VAC); negative pressure wound therapy (NPWT); lymph node; compression

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Introduction

Successful graft take after split thickness skin graft (STSG) reconstruction is dependent on a variety of factors. Particularly in the lower limb, the effects of gravity and local swelling can be a significant issue, mitigated by minimal mobilisation and leg elevation. The effect of oedema holds greater magnitude in patients that have had an ancillary lymph node procedure, such as inguinal node dissection or even sentinel node biopsy after wide local excision of an aggressive cutaneous malignancy. In these patients, graft morbidity is increased due to the possibility of ensuing lymphoedema.

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Postoperative care in a closely supervised fashion is therefore just as important if not more so than the index procedure to ensure successful graft take, a process which may take up to 6 weeks (1). A variety of strategies have been described in the literature such as topical phenytoin, platelet rich plasma (PRP) and fibrin sealants (2,3). Extra-procedural factors include patient factors such as diabetes, underlying infection or colonisation with certain flora particularly pseudomonas (4). More simply, compression can be used to ensure adequate adhesion between the graft and donor bed and minimise subcutaneous collections interfering with the early processes of take.

Most commonly, negative pressure wound therapy (NPWT) is a well-established postoperative adjunct to promote graft take (5-7). Such therapy also works on a similar theoretical basis of removing excess tissue fluid from the extravascular space, thereby decreasing capillary after load and promoting inosculation with subsequent revascularization (8). Other benefits may potentially be related to gene expression for cell proliferation and inflammation with down regulation of genes representing epidermal differentiation (9). NPWT can be also used as a neoadjuvant technique is which a defect is reduced or an area of exposed bone or tendon is made ready for grafting through high-quality granulation (10).

Such devices, however, are expensive, require familiarity and are not always available readily (11). Hence, simpler devices or methods to achieve an adequate level of pressure would be of real clinical value. The objective of this scoping review is to establish current evidence in the literature to support the efficacy of postoperative compression therapy in STSG take, particularly in patients susceptible to lymphoedema. A scoping review method was chosen for the relative paucity in literature on this niche topic. We present the following article in accordance with the PRISMA-ScR reporting checklist (available at https://gs.amegroups.com/article/view/10.21037/gs-22-468/rc).

Highlight box

Key findings

- There is limited evidence for the management of lymphoedema in patients undergoing STSG and an ancillary lymph node procedure.

What is known, and what is new?

- Compression therapy has been used to manage lymphoedema in other settings.
- Such therapy may be a simple adjunct in managing the morbidity of this complication.

What is the implication, and what should change now?

- Larger, multicenter trials will be of value in addressing the postoperative management of lymphoedema in patients undergoing lower limb STSG.

Methods

An initial PubMed literature search was performed in August 2022 regarding STSG and compression therapy after lymph node resection, yielding no results. This search was expanded to include compression therapy for STSG yielding 58 results. Data is scarce regarding compression therapy post STSG let alone those patients susceptible to lymphoedema with an ancillary lymph node procedure hence the search was expanded further to include the terms "pressure", "compression" and "split thickness skin graft". This generated 383 articles for title and abstract review. Exclusions included unrelated articles and papers describing the neoadjuvant usage of the technique to prepare a wound bed for future grafting or delayed closure. No automation tools were used during this process.

One hundred articles remained for review describing methods to promote STSG take after application. Of these, 12 were related to the use of compression only to promote STSG take. Eighty articles described the use of NPWT to promote graft take in a variety of settings: primarily for reconstruction after necrotising infection (n=15), resection of malignancy (n=14), chronic wounds (n=13), burns (n=10) and trauma (n=9). The general use of NPWT was described in 19 papers. The remaining articles were kept for in depth discussion of the effect of controlled positive and negative pressure on graft take (8). A summary of this stratification is demonstrated in *Figure 1*.

Results

The evidence for long term compression in promoting STSG take in any setting reflects a minority of the published literature on graft survival in this setting (12/100, 12%), with the literature highly supporting the use of NPWT as a preferred adjunct (80/100, 80%). Furthermore, STSG reconstruction after malignancy forms a small subset of a variety of indications for grafting reported in the literature, limiting the evidence for this subset even further (14/80, 17.5%). Within the subset of malignancy, many of these articles were largely focused on reporting closure of donor sites. The more frequently reported indications for

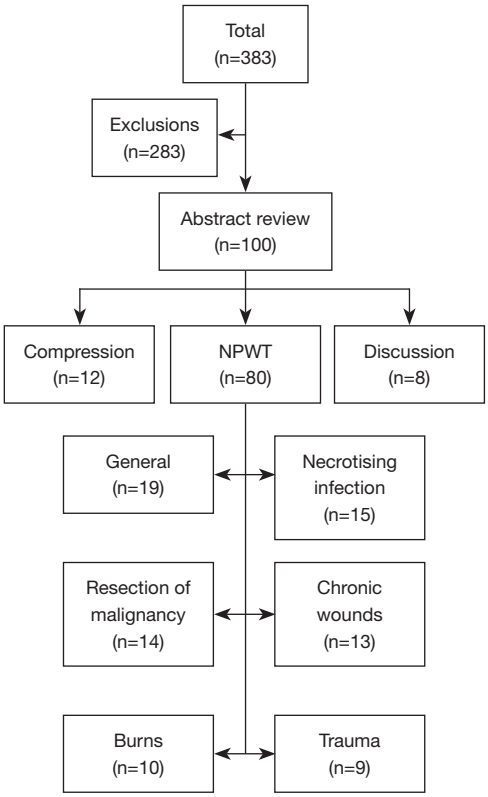

Figure 1 Flow diagram of literature review. NPWT, negative pressure wound therapy.

STSG were in more emergent scenarios such as necrotising infection (15/80, 18.75%) burns (10/80, 12.5%) and trauma (9/80, 11.25%).

Compression therapy after resection of lower malignancy with a concurrent lymph node procedure is an information gap and therefore represents a modest deficiency in the literature. Similarly, NPWT or any form of therapy to promote STSG taken in the setting of lymphoedema risk is absent from the global surgical evidence.

Discussion

Oedema of any sort can compromise STSG take, and management of such is essential for skin graft survival. Interestingly STSG may hold lymphatic capillaries, as suggested by a report of a patient with a circumferential STSG after debridement for necrotising fasciitis, and Indocyanine Green (ICG) application proving lymph transfer from below to above the graft site (12). Hence, lymphoedema poses particular risk to patients undergoing STSG reconstruction with an ancillary lymph node procedure. Certainly, lymphatic leak after such a procedure can be a complex sequelae that is difficult to treat, exploring anastomotic and free flap techniques to address (13).

A simple anecdotal adjunct to address this is long term compression therapy to minimize fluid accumulation. Other benefits include its simple and cost-effective use, while also being widely available with alternative forms of compression made from off the shelf components. Further adjuncts such as a described stapled tie-over stent can be added to further facilitate graft fixation and immobilisation (14). The current review has demonstrated that the literature on this subject is moderately deficient.

Pressure garments were demonstrated in one paper to have the additional benefits of improved scar quality and return to function, in patients with full thickness burns of the hand (15). This was also supported on a molecular basis, with pressure garment therapy elevating expression of metalloproteinases without an effect on collagen expression. Regarding duration, 14 days seems more efficacious that the standard five-day period used at our institution to facilitate successful graft take (16). In conjunction with hydrotherapy, glove compression also had cosmetic and functional benefits in another study of patients with high degree hand burns (17).

There are some negatives to NPWT that compression may mitigate. One example is that compression with an occlusive dressing can be more tolerated by patients compared to a high-pressure vacuum (18). The simplicity of compression could also mitigate the pain associated with frequent dressing or vacuum-assisted closure (VAC) machine changes. Furthermore, one study proved compression with conventional dressings to be noninferior to NPWT, while being cheaper and associated with a higher rate of graft take and lower rate of infection. This was however limited by a relatively small sample size and modest P value proving the results unconvincingly significant (19).

Lastly, and importantly, in low-risk wounds, the price associated with VAC may not be justified, and in this setting simpler methods of compression are better indicated (20). The argument of using compression over NPWT from a cost effectiveness standpoint was also supported in one study for the closure of radial forearm donor sites (21). Particularly to the upper limb, which is a more cosmetically important reconstructive area, compression had the benefits of reduced scar hypertrophy and better colour match (22).

It should not be ignored that NPWT has moderate benefits over compression, particularly of enhancing blood flow, removal of debris, and increase in granulation, all of which may be beneficial in the oncological population (23).

Even though compression is rarely described in the literature for the described cohort, Sapino *et al.* described the efficacy of VAC therapy in the promotion of lower limb skin grafts, a selection of which were post tumour resection (24). Conversely, it is non-descript if any of these patients had lymph node procedures in addition. Particularly in the lymphoedema population, application of a circumferential VAC has been used in patients undergoing penile reconstruction secondary to elephantiasis (25). Modifications of the conventional VAC dressings may mitigate its associated cost (11). The high pressure offered by more advanced machines may also not be necessary, with comparable rates of successful take at lower pressures (26).

There is some limitation inherent to this study, primarily the paucity of literature on what is a broad yet niche topic. Similarly, in relation to the method of a scoping review in itself, such a process provides a broad overview of the subject and indicates areas of further research. This contrasts with a formal systematic review that can be replicated by a separate author according to a protocol and an ensuing critical appraisal.

Conclusions

The current literature for postoperative care of patients undergoing STSG after oncological resection is nearly absent. The impact of compression need not be underestimated, but the addition of a method of fluid evacuation would be of possible clinical benefit. When comparing methods of graft fixation, in addition to take and infection risk, degree of take, return to function, cosmetic appearance, scar quality and cost are additional outcomes that should be considered. The use of compression in the discussed population of patients would be best assessed in a large scale, prospective fashion.

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Footnote

Reporting Checklist: The authors have completed the PRISMA-ScR reporting checklist. Available at https://gs.amegroups.com/article/view/10.21037/gs-22-468/rc

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