INTI JOURNAL | Vol.2025, Issue 5, No.22
eISSN:2600-7320

Manual Soft-Tissue Mobilization in the Management of Hypertrophic Burn Scars: A systematic Review

Joel Mathews*, Karishma Chauhan, Jeffery Samuel R

St. John's College of Physiotherapy, St. John's Medical College Hospital (SJMCH), Bangalore, Karnataka, India

***Email:** joelmathewsvarghese@gmail.com

Abstract

Burn scars continue to be a prominent public health problem worldwide, and even in developed nations, survivors of such injuries often develop hypertrophic scars due to excessive collagen deposition, pain, pruritus, cosmetic issues, and limited mobility. This systematic review aimed to identify the effectiveness of soft tissue mobilization (STM) manual techniques in the treatment of hypertrophic scars in burn patients. An extensive search was performed in the electronic databases of the PubMed, Scopus, Google Scholar, and Cochrane Library for published literature from 2017 to the present using the search terms "burn," "hypertrophic scar," "massage," "soft tissue mobilization," and "manual therapy" using the Boolean algorithm. A total of 11 studies, following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analyses, fulfilled the inclusion criteria and thus rendered the systematic literature review. The literature included consisted of randomized controlled trials, quasi-experiments, and systematic reviews of burn patients that utilized STM. There was a positive correlation of STM techniques such as circular massage, linear massage, Deep Tissue Massage, and Cross Friction in the STM approach to improved scar elasticity, thickness, pain, itching, and mobility in the included literature in comparison to conservative treatments. This systematic literature review shows that STM is a novel, non-invasive method of adjunct rehabilitation in patients suffering from post-burn scars in medicine.

Keywords

Hypertrophic burn scars, soft tissue mobilization, Massage therapy, Scar management

Introduction

Burns are a significant global concern for public health and disproportionately common in developing countries like India with an estimated 6–7 million burn injuries occurring annually. Women and children can become more vulnerable to these injuries with domestic accidents related to fires and scald injuries. Even with developments in acute burn management along with burn

Submission: 1 September 2025; **Acceptance:** 20 November 2025; **Available online:** December 2025

units and advanced methods of management, a substantial number of burn patients continue to suffer from complications like hypertrophic scarring, contractures, pain, and pruritis.

Hypertrophic scar formation occurs as a result of the abnormal deposition of collagen within the established scar borders in the burned areas. The main clinical features associated with hypertrophic scarring include the presence of raised, hard, and reddened tissue, as well as the associated discomfort of pain, itch, sensitivity, and stiffness from the consequent contractures. Apart from the somatic disability, hypertrophic scarring can also pose negative influences on the psyche and life quality of the patient.

Burn management goes well beyond the realm of acute care to include infection control, surgical intervention as necessary, and comprehensive rehabilitation. Physiotherapy is essential in preventing contractures and restoring functional capacity. In this regard, manual soft-tissue mobilization has become a popular non-pharmacological approach in managing hypertrophic burn scars within the rehabilitative regime. STM is relatively inexpensive, non-invasive, and simple to teach and apply across a wide range of clinical settings. Proposed mechanisms of action include enhanced local blood circulation, reduction in tissue adhesions, modulation of fibroblast activity, and reorganization and alignment of collagen fibers.

A growing body of evidence supports the clinical application of manual STM for hypertrophic burn scar management. Massage-based techniques of STM, specifically circular, linear, and cross-friction strokes, have been noted to enhance elasticity and reduce the thickness of scars (Ault et al., 2018). Randomized controlled trials and clinical studies have also demonstrated improvements in scar pliability, vascularity, and symptom relief post-STM interventions (Nédélec et al., 2019; Elshazly et al., 2021). Additionally, systematic reviews and meta-analyses have reported a reduction in scar severity and improvements in functional outcomes and patient-reported measures subsequent to STM-based interventions (Deflorin et al., 2020; Lin et al., 2023; Barnes et al., 2024).

Given the high prevalence of hypertrophic scarring following burn injuries and the growing evidence base to support manual STM, a systematic synthesis of the literature is now warranted. This systematic review will, therefore, critically evaluate the effectiveness of manual soft-tissue mobilization in managing hypertrophic burn scars

Methodology

Study design

This study was conducted as a systematic review of the literature evaluating the effectiveness of soft-tissue mobilization (STM) techniques in the management of hypertrophic burn scars.

Search strategy

An electronic search was carried out between January 2017 and January 2025 in PubMed and the Cochrane Library. The search strategy combined the keywords burn, hypertrophic scar, massage,

soft-tissue mobilization, and scar management with appropriate Medical Subject Headings (MeSH) terms. Boolean operators “AND” and “OR” were used to combine terms and retrieve studies relevant to the objectives of this review. Other details are as follows:

Keywords used were: i) Hypertrophic burn scars; ii) Soft tissue mobilization; iii) Massage therapy; iv) Scar management.

Databased: PubMed & Cochrane Library

Inclusion criteria: Studies were included if they met the following criteria: **i)** Published in English between 2017 and 2025**; ii)** Participants with post-burn hypertrophic scars**; iii)** Intervention involving manual soft-tissue mobilization techniques; **iv)** Designs including randomized controlled trials, quasi-experimental studies, systematic reviews, or meta-analyses

Exclusion criteria: i) Full text not available; ii) Non-English language publications; iii) Duplicate records; iv) Studies not meeting inclusion criteria; v) Studies involving keloid scars exclusively or non-burn scars.

Data extraction and quality appraisal: Data extracted included participant characteristics, intervention type and dosage, comparators, outcome measures, and key findings. Methodological quality was assessed using: i) PEDro scale for randomized controlled trials; ii) CASP checklists for systematic reviews and qualitative studies; iii) JBI critical appraisal tools for appropriate study designs**.** All records and citations were organized using reference management software to ensure systematic documentation.

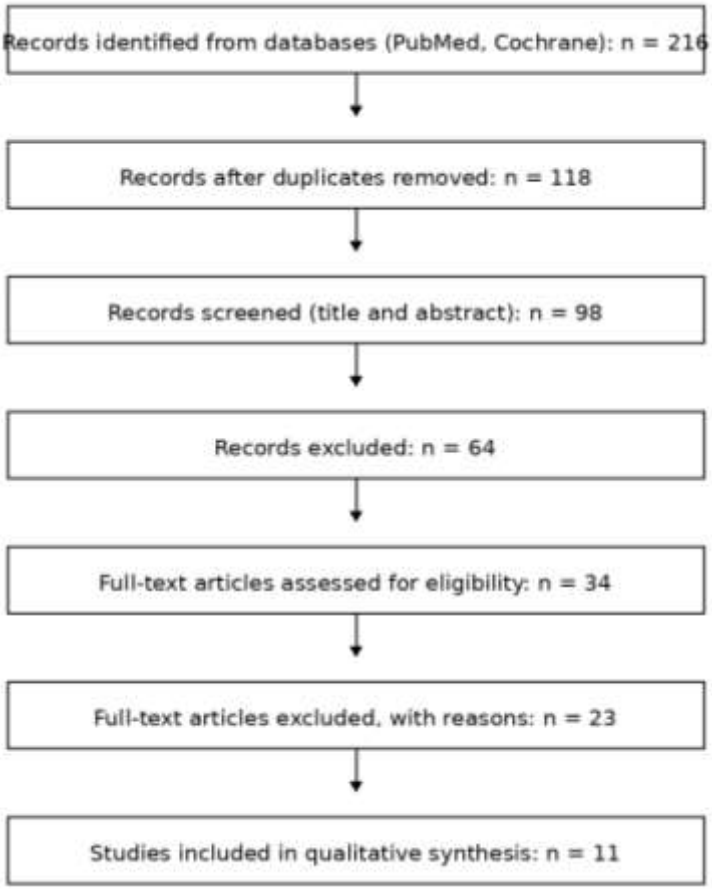

Figure 1. PRISMA Flow Diagram demonstrating Inclusion of studies

Table 1. Review of Literature

Study	**Objective**	**Methods**	**Key Findings**	**Critical Review**
Edger-Lacoursière *et al*. (2025)	The aim of this review article is to summarize and clinically apply the evidence that supports or refutes the use of common conservative treatment interventions for scar management employed after burn injury	The review is structured around several intervention domains (edema, pressure, gels, massage, stretching,); integrates basic science with clinical data.	soft tissue mobilization techniques including friction or oscillation massage technique were used for targeted scar mobility and Effleurage or petrissage technique was used for pain and appearance these STM techniques had a positive impact in scar pliability, pruritus, pain, and contracture and there was positive impact.	Broad and up-to-date, but not all conclusions are derived from RCT-level evidence; potential bias in narrative selection; clinical applicability needs RCT support.

Barnes *et al*. (2024)	To evaluate the efficacy of specific massage techniques on hypertrophic burn scars (contracture, pruritus, pain, visibility).	Systematic review (10 studies, various designs); risk of bias via Cochrane/ROBINS-I;	9 out of 10 included studies reported significant improvements in scar pruritus, pain, visibility, or function; friction + oscillation was most used for function; longer sessions (35 min) of effleurage/petrissage for pain and appearance.	Small, heterogeneous studies; massage techniques varied widely; most predated RCT standards; need for large, well-controlled RCTs.
Sinha *et al*. (2024)	To assess interventions for treating post-burn pruritus in acute scar phase.	Cochrane Systematic Review of 25 RCTs encompassing 1,166 randomized participants	Physical modalities (massage techniques) reduce itch (SMD ≈ –0.86 for massage; ~4–6 points on VAS); enalapril ointment probably reduces itch; silicone gel and Proves moisturizer have little effect	Certainty ranged from low to moderate; most trials had small n, unclear blinding; secondary outcomes were often unreported.
Nédélec *et al*. (2024)	To pilot-test the effectiveness of 12 weeks endermotherapy (vacuum + rollers) on hypertrophic scar outcomes in adult burn survivors.	Randomized, within-patient, single-blinded pilot; adjacent/mirror scars in same individual received endermotherapy vs. control; blinded rater assessment.	statistically significand's between-scar differences in elasticity, erythema, melanin, thickness, or TEWL after 12 weeks.	Very small (pilot) sample, short duration, limited control for placebo; further fully powered RCTs needed.
Lin *et al*. (2023)	To determine the effects of scar massage on burn scars via systematic review and meta-analysis.	Review & meta-analysis of RCTs and CCTs comparing massage vs. control on hypertrophic burn scars (pruritus, pain, thickness, pliability).	Massage associated with moderate reduction in itch and scar thickness, improved pliability; results significant but heterogeneity high; optimal timing/intensity unclear.	Included studies had differing protocols, short follow-up, and variable outcome measures; meta-regression limited.
Elshazly *et al*. (2021)	To assess the effect of combining vacuum massage	Controlled clinical trial; participants randomized to	The massage technique reportedly improved scar pliability and	Small sample, open-label, and without sham ESWT; specific

	with shock wave therapy on post-burn scars.	vacuum massage vs control	reduced redness (erythema) and thickness, compared with control.	parameters often poorly reported; replicability uncertain.
Deflorin *et al*. (2020)	To systematically evaluate conservative physical management (massage, stretching.) of scar tissue.	Systematic review and meta-analysis of physical therapies for various scar types, including burns.	The study found that Physical scar management yielded significant moderate-to-strong improvements in pain, pruritus, pigmentation pliability, surface area and scar thickness	Variability in scar types pooled; burn-specific conclusions limited; many studies were non-randomized.
Nédélec *et al*. (2019)	To evaluate immediate and long-term effects of massage on adult post-burn scars.	RCT within-patient design; one scar massaged regularly vs. the other control;	Massage was associated with improved skin softness and reduced thickness at early (3 months) and long-term follow-up;	Single-center, small n, and intervention protocol details limited; inconsistent follow-up compliance.

Results

A total of 11 studies fulfilled the inclusion criteria and were therefore subjected to qualitative synthesis. These included randomized controlled trials, quasi-experiments, controlled clinical trials, and systematic reviews investigating mobilization of soft tissues or massage therapy for hypertrophic scars following burn injuries.

Most of the studies showed improvements in pain, pruritis, scar thickness, and pliability, whereas some studies also demonstrated improvements in pigmentation and functional mobility. Different STM maneuvers were used in various studies, some of which included friction massage, effleurage, petrissage, oscillation, and vacuum massage.

The differences between studies, such as size, use of controls, intervention variables, duration, POSAS, VSS, and ultrasound evaluations, can also be observed in Table 1. Generally, systematic reviews have positive findings with STM, whereas smaller-scale pilot studies have provided evidence of this effect.

Discussion

This systematic review aimed to integrate available evidence on the impact of soft tissue mobilization (STM) modalities in the treatment of hypertrophic scar lesions in patients with burns. Indeed, available evidence from the selected articles indicates that STM may be associated with an improvement in scar elasticity, pliability, pruritus, pain, and patients' perception (Barnes et al., 2024; Lin et al., 2023). The results are important because hypertrophic scars are associated with

different complications in patients with burns in terms of pain, functional impairment, disfigurement, as well as psychosocial impairment. More robust evidence is available from clinical trials and systematic reviews that showed a reduction in pruritus and pain and improvement in elasticity and thickness after intensive massage therapy over a period of weeks (Sinha et al., 2024; Nédélec et al., 2019; Lin et al., 2023). Such high-level evidence allows one to build moderate confidence in STM therapy as an additional approach in the treatment of burns.

However, the existing body of literature also comprises pilot studies, quasi-experimental studies, or small-scale observation studies that, while mostly positive, are restricted due to the smaller sample size, lack of blinding, variability of protocols, or short follow-up times (Elshazly et al., 2021; Najafi Ghezeljeh et al., 2017). Narrative reviews independently corroborate the usage of conservative scar management but stress that many of these recommendations have, to date, not been proven or ascertained using adequately sized, adequately constructed RCTs (Edger-Lacoursière et al., 2025; Ault et al., 2018). Consequently, the general level of conclusional certainty, although positive, remains restricted due to the nature of the studies available. The presumed mechanisms behind STM benefits include mechanotransduction, by virtue of manual pressure and shear stress, promoting collagen reorientation, downregulating adhesions, and modulating fibroblast function, leading to increased scar flexibility and resistance to stiffness (Barnes et al., 2024; Deflorin et al., 2020).

Additionally, circulation and edema reduction may also help alleviate symptoms in pain and itching. In practice, many trials showed additional benefits in terms of improved joint flexibility and resilience, hence facilitating the inclusion of STM in long-term rehabilitation treatment after the healing of the wound, during the phases of remodeling (Lin et al., 2023; Nédélec et al., 2019). The values of each treatment parameter differ significantly in all trials, although on average, STM was carried out from 5 to 30 minutes in one to three weekly therapeutic sessions over an 8 to 12-week period, and possibly lengthy (Barnes et al., 2024; Lin et al., 2023).

This also underscores the current drawback, having no standard and precise methodology, such as type and preferred modalities of massaging, force, time, and treatment schedule. However, all existing studies have some limitations, such as differences in protocols of intervention and use of Vancouver Scar Scale, POSAS, and ultrasound evaluation criteria (Lin et al., 2023; Nédélec et al., 2024). There is a lack of long-term follow-up information available, making it difficult to judge to what extent of time the effect of treatment would last. Besides, because manual therapy involves some inherent difficulties concerning concealment of Allocation and, in turn, risks of performance and expectation biases, there is a possibility of biases being more common in manual therapy studies (Ault et al., 2018; Deflorin et al., 2020). However, taking all these difficulties and limitations into consideration, all signs point to STM being an attractive and inexpensive and non-invasive procedure that could be easily applied to clinical and nonclinical settings (Barnes et al., 2024; Edger-Lacoursière et al., 2025).

Conflict of Interest Statement

The authors declare no conflict of interest in connection with this literature review on manual soft-tissue mobilization in the management of hypertrophic burn scars. No financial, personal, or

institutional factors have influenced the research process, interpretation of findings, or the conclusions drawn in this review.

Acknowledgment

The authors would like to express their sincere appreciation to all researchers, clinicians, and rehabilitation specialists whose contributions have advanced the field of burn care and scar management. We also thank our mentors, academic peers, and affiliated institutions for their ongoing support and guidance throughout the preparation of this review. Special recognition is extended to the physiotherapists and healthcare professionals who continually strive to improve the quality of life for burn survivors through evidence-based interventions such as manual soft-tissue mobilization.

References

Ault, P., Plaza, A., & Paratz, J. (2018). Scar massage for hypertrophic burn scarring: A systematic review. *Burns, 44*(1), 24–38. https://doi.org/10.1016/j.burns.2017.05.006

Barnes, S. P., Ma, Y., Patel, B., & Muthayya, P. (2024). Efficacy of massage techniques for hypertrophic burn scars: A systematic review of the literature. *Journal of Burn Care & Research, 45*(2), 356–365. https://doi.org/10.1093/jbcr/irad140

Deflorin, C., Hohenauer, E., Stoop, R., van Daele, U., Clijsen, R., & Taeymans, J. (2020). Physical management of scar tissue: A systematic review and meta-analysis. *Journal of Alternative and Complementary Medicine, 26*(10), 854–865. https://doi.org/10.1089/acm.2020.0109

Edger-Lacoursière, Z., Zhu, M., Jean, S., Marois-Pagé, E., & Nédélec, B. (2025). Evidence supporting conservative scar management interventions following burn injury: A review article. *Journal of Burn Care & Research, 46*(3), 504–514. https://doi.org/10.1093/jbcr/irae204

Elshazly, M., Ahmed, A. A., & Sarhan, M. A. (2021). Effect of combining vacuum massage and shock wave therapy on post-burn scars. *International Journal of Current Research and Review, 13*(22), 68–72. https://doi.org/10.31782/IJCRR.2021.132214

Lin, T. R., Chou, F. H., Wang, H. H., & Wang, R. H. (2023). Effects of scar massage on burn scars: A systematic review and meta-analysis. *Journal of Clinical Nursing, 32*(13–14), 3144–3154. https://doi.org/10.1111/jocn.16420

Najafi Ghezeljeh, T., Mohades Ardebili, F., & Rafii, F. (2017). The effects of massage and music on pain, anxiety, and relaxation in burn patients: A randomized controlled clinical trial. *Burns, 43*(5), 1034–1043. https://doi.org/10.1016/j.burns.2017.01.011

Nédélec, B., Couture, M. A., Calva, V., Poulin, C., Chouinard, A., Shashoua, D., Gauthier, N., Correa, J. A., de Oliveira, A., Mazer, B., & LaSalle, L. (2019). Randomized controlled trial of the immediate and long-term effects of massage on adult postburn scars. *Burns, 45*(1), 128–139. https://doi.org/10.1016/j.burns.2018.08.018

Nédélec, B., Edger-Lacoursière, Z., Gauthier, N., Marois-Pagé, E., & Jean, S. (2024). Randomized controlled within-patient single-blinded pilot study evaluating 12 weeks of endermotherapy in adult burn survivors. *Burns, 50*(9), Article 107269. https://doi.org/10.1016/j.burns.2024.09.008

Sinha, S., Gabriel, V. A., Arora, R. K., Shin, W., Scott, J., Bharadia, S. K., Verly, M., Rahmani, W. M., Nickerson, D. A., Fraulin, F. O., Chatterjee, P., Ahuja, R. B., & Biernaskie, J. A. (2024). Interventions for postburn pruritus. *Cochrane Database of Systematic Reviews*, 2024(6), CD013468. https://doi.org/10.1002/14651858.CD013468.pub2