WEP Warwick Evans Publishing

International Journal of Public Health and Medical Research

ISSN: 3006-7707 (Print), ISSN: 3006-3752 (Online) | Volume 4, Number 2, Year 2025
DOI: https://doi.org/10.62051/ijphmr.v4n2.03
Journal homepage: https://wepub.org/index.php/IJPHMR/index

Summary of Best Evidence on the Application Timing and Management Strategies of Compression Therapy for Chronic Wounds

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ABSTRACT

Background: Chronic wounds, including venous ulcers and diabetic foot ulcers, impose significant clinical and economic burdens globally. Compression therapy is a cornerstone intervention, yet its optimal application timing and management strategies lack standardized guidelines. Methods: According to the '6S' evidence resource model, evidence retrieval is searched from the top-down and collected relevant guidelines, best practices, evidence summaries, systematic reviews and expert consensus. The retrieval time limit was from the database establishment to 20 March 2025. Two reviewers independently screened and evaluated the literature, and then extracted and summarised the evidence according to the JBI grading of evidence and recommendation system. Results: This study summarizes 18 pieces of evidence in 7 aspects, including indications, contraindications, application, assessment, management strategies, effectiveness, and adverse reactions, related to the application timing and management strategies of compression therapy for chronic wounds. Conclusions: Compression therapy significantly enhances chronic wound healing but requires rigorous contraindication screening and dynamic pressure adjustment. Clinicians should adopt evidence-based protocols integrating ABI assessments and patient education. Future innovations should focus on smart devices and longitudinal outcome tracking.

KEYWORDS

Chronic wound management; Compression therapy; Venous ulcers; Evidence-based guidelines; Contraindications

1. KEW POINTS

A total of 18 best-evidence recommendations on compression therapy for chronic wounds were systematically summarized from seven domains (indications, contraindications, timing, assessment, management strategies, efficacy, and adverse effects) based on the "6S" evidence resource model.

The evidence provides a standardized framework for initiating compression therapy, adjusting pressure parameters, and integrating adjunctive therapies.

2. BACKGROUND

Chronic wounds are clinically defined as "injuries that fail to achieve anatomical integrity and functional restoration after 4 weeks of standardized wound management" [1]. his category encompasses pressure injuries, diabetic foot ulcers, venous ulcers, and arterial ulcers. Epidemiological data reveal a global prevalence of 1.5%-2% for chronic wounds [2], with diabetic foot ulcers accounting for 1.03% prevalence and approximately 9.1 million new cases annually [3] Notably, venous ulcers affect 4% of the population aged over 65, demonstrating a rising incidence trend due to population aging and increasing metabolic disease burden. Recent statistics indicate that global healthcare expenditure on chronic wound management has reached US$89 billion annually, constituting 3.18% of total medical costs [4, 5]. Beyond economic burdens, patients frequently endure recurrent pain, infection risks, psychological distress, and potential limb amputation, significantly compromising quality of life [6, 7]. With advancements in precision medicine and nursing science. Compression Therapy has emerged as a cornerstone intervention for chronic wounds (e.g.venous leg ulcers, lymphedema). Its mechanism involves dual-path regulation through hemodynamic optimization and molecular modulation: Graduated pressure delivery (40-50 mmHg at ankle decreasing to 15-20 mmHg proximally) enhances venous pump function, reduces venous hypertension (40% decrease in capillary leakage), while suppressing inflammatory cytokines and promoting fibroblast proliferation with collagen remodeling [8-10]. Both the International Union of Phlebology (UIP) and European Wound Management Association (EWMA) recognize compression therapy as the gold standard for venous ulcer management [11]. Nevertheless, clinical implementation faces challenges including undefined therapeutic windows, inadequate contraindication screening protocols, and lack of personalized pressure adjustment guidelines, resulting in variable compliance and therapeutic outcomes. The absence of robust evidence-based protocols and standardized operational frameworks substantially hinders clinical application. This study aims to systematically review and synthesize existing evidence on compression therapy for chronic wounds, thereby establishing a scientific foundation for standardized clinical practice.

3. MATERIAL METHODS

3.1. Establishment of the Problem

The PIPOST tool, developed by the Evidence-Based Nursing Center at Fudan University, was utilized to establish a problem related to evidence-based practice. The patient population (P) targeted for the application of evidence consisted of individuals suffering from chronic wounds. The intervention (I) implemented was compression therapy. Clinical medical personnel served as the professionals (P) utilizing the evidence. The outcomes (O) monitored after implementing the evidence encompassed factors such as the duration of wound healing, recurrence intervals, frequency of recurrence, and overall quality of life. Evidence was applied in various settings (S), including hospitals, community environments, and home settings. The types of evidence (T) considered comprised guidelines, best practice methodologies, expert consensus, evidence summaries, systematic reviews, and original research studies.

4. LITERATURE RETRIEVAL STRATEGY

According to the ‘6S’ evidence resource model, evidence retrieval is searched from the top-down. The databases searched included. BMJ Best Practice, Up To Date, National Institute of Health and Clinical Excellence (NICE), National Guideline Clearinghouse, Guideline International Network, Scottish Intercollegiate Guidelines Network, Registered Nurses’ Association of Ontario, Chinese Medlive Guideline Network (CMGN), Australian JBI Evidence-Based Health Care Database, Cochrane Library, PubMed, CINAHL, Embase, Web of Science, China Biology Medicine, China

Knowledge Resource Integrated Database (CNKI), Wanfang and VIP. Relevant professional websites include the Wound, Ostomy and Continence Nurses Society, WOCN website, World Council of Enterostomal Therapists, WCET website, European Venous Forum, EVF website, European Society for Vascular Surgery, ESVS website, Association for the Advancement of Wound Care, AAWC website, Health Service Executive, HSE website. The search terms were created based on the combination of Medical Subject Headings and free terms, and the literature search formula consists of three parts: the first of which was frailty or other manifestations of frailty, the second was intervention/management/prevention or specific measures and the third was a restriction on the type of literature to be searched, as shown below: (compression therapy OR pressure therapy OR elastic bandages OR compression stocking*) AND (chronic wound* or nonhealing wound* or hard healing wound* or pressure ulcer* or bedsore* or pressure sore* or pressure injur* or decubitus ulcer* or varicose ulcer* or venous ulcer* or stasis ulcer* or diabetic foot or diabetic feet or arterial ulcer* or scar* or scar formation or lymphedema) AND (guideline* OR 'practice guideline' OR routine* OR 'recommended practice' OR 'evidence summary' OR consensus* OR 'systematic review' OR 'meta-analysis'). The search timeframe is from database inception to 20 March 2023.

4.1. Literature Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (i) Adult patients (≥18 years old) with a clear diagnosis of chronic wounds (including venous ulcers, diabetic foot ulcers, arterial ulcers or pressure injuries) and receiving compression therapy intervention, regardless of gender, race or underlying diseases; (ii) literature types included guideline, best practice, evidence summary, systematic review and expert consensus; (iii) language was either Chinese or English.

The criteria for exclusion from the study encompassed two primary conditions. (i) any literature categorized as a conference abstract, guideline interpretation, research plan or proposal, or outdated guides that have since been superseded was not included. This ensures that only relevant and contemporary sources are considered to maintain the integrity of the research; (ii) materials that contained incomplete information, whose full texts could not be accessed, or that exhibited a low quality of evaluation were also excluded from the analysis. These criteria were established to enhance the reliability and validity of the findings by focusing solely on high-quality and complete scholarly works.

5. STUDY SELECTION AND DATA EXTRACTION

Two reviewers conducted a thorough and independent screening of the literature collected, adhering strictly to predetermined inclusion and exclusion criteria. In situations where disagreements arose between the reviewers regarding the selection of studies, discussions were held to reach a consensus. If a consensus could not be achieved through discussion, a third author was consulted to provide an impartial resolution. Following this screening process, the same reviewers proceeded to extract data independently, utilizing a standardized data extraction form to ensure consistency and reliability in their approach. Importantly, during this phase, each reviewer was blinded to the other's data extraction process to minimize bias. The extracted data encompassed essential characteristics of the studies, including information such as the first author's name, their affiliated institution, the year of publication, the source, the type of evidence presented, and the specific topic addressed in the article.

6. LITERATURE QUALITY EVALUATION CRITERIA

6.1. Guideline

The Appraisal of Guidelines for Research and Evaluation (AGREE II) tool was utilized to assess the quality of the guidelines that were included in this study [12]. This evaluation framework comprises

a total of 23 distinct items categorized across six different domains. Each item is rated on a Likert scale ranging from 1 to 7, where a score of 1 indicates strong disagreement with the statement and a score of 7 signifies strong agreement. To provide a comprehensive assessment, the score for each domain is expressed as a standardized percentage, which is calculated based on the cumulative scores assigned to each individual item within that domain. The formula for determining the standardized percentage for each field is as follows: it involves taking the obtained score for the domain, subtracting the least possible score, and then dividing that result by the difference between the maximum and least possible scores, finally multiplying by 100 to obtain a percentage representation [13].

6.2. Systematic Reviews

The systematic reviews that were incorporated into the analysis underwent a thorough evaluation utilizing the AMSTAR 2 tool. This tool comprises 11 distinct entries designed to assess various aspects of systematic reviews. Each of these entries was categorized based on specific criteria, resulting in ratings of ‘yes’, ‘no’, ‘unclear’, or ‘not adopted’. This rigorous assessment process provides a comprehensive overview of the methodological quality and reliability of the systematic reviews included in the study. In addition to the evaluation of systematic reviews, a consensus among experts was sought to further enhance the understanding and credibility of the findings. This consensus is critical, as it offers a collective agreement among professionals in the field, ensuring that the conclusions drawn from the systematic reviews are not only robust but also aligned with current best practices and expert opinions in the relevant domains.

6.3. Expert Consensus

The assessment of the quality of the expert consensus included in this study was conducted utilizing the Expert Consensus Standard, which was established in 2016 by the Joanna Briggs Institute (JBI) Centre for Evidence-Based Health Care located in Australia. This evaluation tool encompasses six specific items that allow for a nuanced judgment, providing responses categorized as ‘yes,’ ‘no,’ ‘unclear,’ or ‘not applicable.’ These categories enable a structured approach to evaluating the consensus quality, ensuring a comprehensive analysis of the expert opinions considered in the study.

6.4. Best Practice and Evidence Summary

In conducting a quality evaluation of best practices and evidence summaries, we revisited the original literature that forms the foundation of the evidence presented. This thorough examination allowed us to identify and select appropriate evaluation tools that were aligned with the specific types of literature we encountered. By ensuring that the evaluation instruments correspond to the literature type, we enhance the reliability and relevance of our assessments, ultimately leading to a more robust understanding of the practices in question.

6.5. Literature Quality Evaluation Process

The quality evaluation process was carried out by two independent reviewers, both of whom possess expertise in evidence-based nursing. Their systematic examination of the relevant literature allowed them to assess the quality and relevance of the studies in question. In situations where the reviewers reached differing conclusions, a third individual, experienced in evidence-based research, intervened to make the final decision. This additional layer of review ensured that the evaluation process remained rigorous and grounded in sound methodology. Furthermore, when disagreements arose regarding the conclusions drawn from the extracted evidence, the reviewers adhered to a specific set of principles for inclusion. These guidelines prioritized the utilization of evidence that was firmly established within an evidence-based framework. Additionally, they emphasized the importance of selecting high-quality studies to ensure the reliability of the findings. Finally, they focused on

incorporating the most recently published and authoritative literature, thereby ensuring that the evaluation was not only based on solid ground but also reflective of the latest advancements and insights in the field. This comprehensive approach to quality evaluation reinforces the integrity and credibility of the findings presented.

6.6. Criteria for Determining Evidence Level and Recommendation Level

The evidence included in this study was rigorously evaluated and categorized using the JBI grading of evidence and recommendation system. This system assigns evidence grades based on the type of research design, resulting in a classification that ranges from levels 1 to 5. Additionally, the evaluation is guided by the FAME framework established by JBI, which assesses the feasibility, appropriateness, meaningfulness, and effectiveness of the evidence presented. Through this comprehensive evaluation process, the level of recommendation for each piece of evidence is determined, distinguishing between A-level recommendations, which are considered strong endorsements, and B-level recommendations, which are viewed as weaker endorsements.

7. RESULTS

7.1. General Characteristics of the Included Literature

The initial search resulted in 1,746 articles. After excluding duplicates and those that did not meet the requirements after reading the title, abstract and full text, a total of 21 publications were finally included, including 4 guidelines [14-17], 1 best practices [18], 4 expert consensus [19-22], 3 evidence summaries [23-25] and 9 systematic reviews [26-34]. The study selection process is presented in Figure 1, and the general information of the included literature is shown in Table 1.

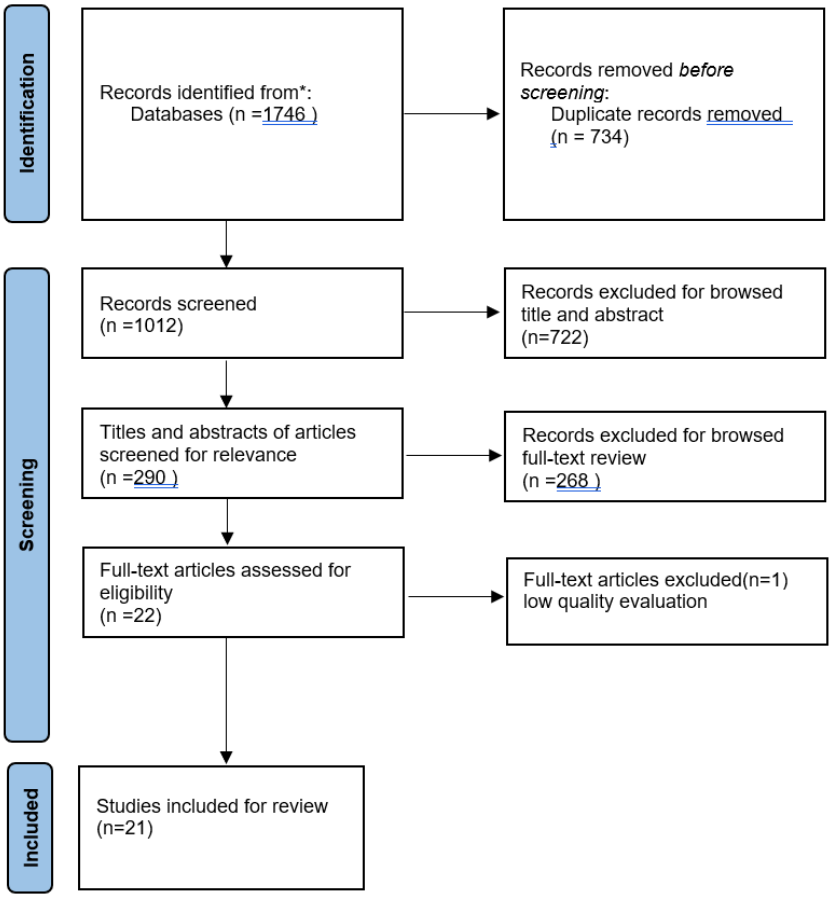

Figure 1. Flow chart of literature screening

Table 1. Basic characteristics of the included studies (n=21)

Included literature	Year	Type of evidence	Literature sources	Topic of the literature
Sun et al.	2025	Guideline	PubMed	Clinical guidelines on compression therapy in venous diseases
Ratliff et al.	2022	Guideline	WOCN	Compression for lower extremity venous disease and lymphedema
Ito et al.	2025	Guideline	Web of science	Guidelines for the management of lower leg ulcers and varicose veins, second edition
Valesky et al.	2024	Guideline	Web of science	Diagnosis and treatment of venous leg ulcers: S2k Guideline of the German Society of Phlebology and Lymphology (DGPL)
Shi et al.	2021	Systematic Reviews	The Cochrane Library	Compression bandages or stockings versus no compression for treating venous leg ulcers
de Moraes Silva et al.	2024	Systematic Reviews	The Cochrane Library	Compression for preventing recurrence of venous ulcers
Mirakhmedova et al.	2023	Systematic Reviews	Embase	Daily Duration of Compression Treatment in Chronic Venous Disease Patients: A Systematic Review
Ferguson et al.	2024	Systematic Reviews	PubMed	Decision-making on the use of compression hosiery and compression bandaging: a systematic review
Li et al.	2022	Systematic Reviews	PubMed	Compression Therapy for the Patients With Breast Cancer: A Meta-analysis of Randomized Controlled Trials
Declan Patton et al.	2023	Systematic Reviews	Web of science	A meta-review of the impact of compression therapy on venous leg ulcer healing
Nischwitz et al.	2020	Systematic Reviews	Embase	Evidence-based therapy in hyp-ertrophic scars
Walsh et al.	2023	Systematic Reviews	Embase	Keloid treatments: an evidence-based systematic review of recent advances
García-Chico et al.	2025	Systematic Reviews	Web of science	Wrapping up the evidence: bandaging in breast cancer-related lymphedema
Vignes et al.	2021	consensus study	Web of science	Primary lymphedema French National Diagnosis and Care Protocol
E. Rabe et al.	2020	consensus study	PubMed	Risks and contraindications of medical compression treatment
Finlayson et al.	2023	consensus study	Embase	Priority topics for chronic wound research in Australia: a consensus study
Lurie et al.	2022	consensus study	PubMed	The American Venous Forum, American Vein and Lymphatic Society and the Society for Vascular Medicine expert opinion consensus on lymphedema diagnosis and treatment
Li et al.	2022	Best evidence summary	VIP	Best evidence summary for intermittent pneumatic compression in treatment of patientswith breast cancerrelated lymphedema
Mu et al.	2022	Best evidence summary	CNKI	Summary of the best evidence for self-management in patients with venous leg ulcer
Zheng et al.	2020	Best evidence summary	VIP	Evidence summary of compression therapy in patients with venous leg ulcer
Ruiz et al.	2024	a best practice	JBI	Compression therapy in patients with venous leg ulcers: a best practice implementation project

Note: WOCN: Wound, Ostomy, and Continence Nurses Society; JBI: Joanna Briggs Institute

7.2. Quality Evaluation Results of the Included Literature

7.2.1. Quality evaluation results of the guidelines

There were 4 guidelines included in this study [14-17]. Four guidelines have ≥60% percentage of standardisation in six fields, with a recommendation level of A. The results of the standardised scores for each domain and the overall quality evaluation of the guidelines are shown in Table 2.

Table 2. Methodological quality evaluation results of the guidelines

Guidelines	Percentage of standardization in each area (%)							
	Scope purpose	Participant	The rigor of the designation	Clarity of expression	Applicability	Editorial independence	Quality score	Recommendation level
Sun et al.	95	70	85	90	75	80	82.5	A
Ratliff et.al.	94	89	85	92	78	83	86.8	A
Takaaki-Ito et al.	88	83	92	94	75	100	88.7	A
Valesky et al.	90	85	75	90	76	77	82.2	A

Note: Standardisation percentage of each field = (obtained score − minimum possible score) / (maximum possible score − minimum possible score) × 100%; Recommendation level: if the standardised percentage of six fields is >60%, it is highly recommended (level A); if >3 areas have a standardised percentage > 30% and < 60% are recommended (level B); if there are ≥3 areas with a standardised percentage < 30%, it is not recommended (level C).

7.2.2. Quality evaluation results of systematic reviews

In all, 4 literatures were evaluated as high quality, five as medium quality. Detailed quality evaluation contents are shown in Supplementary Table 1.

7.2.3. Quality evaluation results of expert consensuses

Four expert consensus articles were independently evaluated by two evaluators according to JBI expert opinion quality evaluation tool, and the overall quality of the articles was medium or high, so they were approved for inclusion. Detailed quality evaluation contents are shown in Supplementary Table 2.

7.2.4. Quality evaluation results of the best practice and evidence summary

For quality evaluation of 1 best practices and 3 evidence summaries.The one recommended practice is all from

the JB I Evidence-Based Health Care Center, and the original evidence level and recommendation strength are directly selected,we reviewed and evaluated the original literature on which the evidence was based, and the overall quality was high, all included in this study.

7.3. Summary and Description of Evidence

The evidence was extracted from the final literature, and the evidence was evaluated by JBI grading of evidence and recommendation system. Through the induction and integration of the evidence, the evidence was finally summarised from seven aspects.There are a total of 31 pieces of evidence, including indications, contraindications, application timing, evaluation, management strategies, effectiveness and adverse reactions.

Table 3. Summary of best evidence on the application timing and management strategies of compression therapy for chronic wounds

Category	Evidence Content	Evidence Level
Indications	1. Indications: Venous leg ulcers, chronic venous insufficiency (CVI), lymphedema, venous thromboembolism (VTE), burn scars [14, 15, 17]	1a
Contraindication	2. Absolute Contraindications: Ankle-Brachial Index (ABI) ≤0.5 or ankle systolic pressure <60 mmHg; uncontrolled congestive heart failure (NYHA class IV); acute deep vein thrombosis (DVT) without anticoagulation therapy; acute infection [17, 19]	1a
	3. Relative Contraindications: Use with caution when ABI is 0.6–0.8; severe diabetic neuropathy with sensory loss; active cellulitis or deep infection; uncontrolled hypertension; severe peripheral arterial disease (PAD); thrombocytopenia; skin ulceration or tumor recurrence areas; cautious application for patients with sensory impairment [15, 16, 23, 25]	2b
Timing of Application	4. Venous Ulcers: Begin compression therapy immediately after diagnosis, ≥6 hours daily until healing, lifelong maintenance post-healing. For active ulcers, apply upon waking and remove before bedtime. Combine with intermittent pneumatic compression (IPC) if standard therapy fails [15, 25]	1b
	5. DVT Management: Start compression within 24 hours of acute DVT diagnosis. Proximal DVT requires 12 months of compression; distal DVT requires ≥3 months [14, 25]	1a
	6. Post-Varicose Vein Surgery (e.g., saphenous vein stripping, extensive phlebectomy, endovenous thermal ablation (EVTA)): Apply compression immediately for 24–48 hours, continue for 2–3 months [14]	1a
	7. Lymphedema: Initiate compression therapy upon diagnosis for ISL (International Society of Lymphology) stages I–III (combined with Complete Decongestive Therapy (CDT)) [15, 17]	1a
Assessment Methods	8. Chronic Wound Assessment: Includes clinical evaluation (history of ulcer duration, vascular/diabetic/infectious history), ulcer characteristics (size, location, depth, exudate), skin condition (pigmentation, eczema, lipodermatosclerosis), edema features (pitting/non-pitting), CEAP classification, ISL staging, Villalta score; objective tests (ABI, Doppler ultrasound, MRI/MRA); subjective assessments (pain scores, POSAS (Patient and Observer Scar Assessment Scale), QoL (Quality of Life) surveys) [15, 17, 19, 25].	1a
Management Strategies	9. Pressure Selection: Venous ulcers (active phase: 40–50 mmHg elastic bandages; stable phase: 20–30 mmHg gradient stockings). Lymphedema (initial phase: >40 mmHg multilayer bandages; maintenance phase: adjustable non-elastic garments). Mixed arterial disease (ABI>0.5): <40 mmHg with non-elastic materials [15]	1b
	10. Techniques: Elastic bandages for active ulcers (applied spirally from foot with silicone padding); gradient stockings (18–24 mmHg for stable phase); double-layer stockings for patients with donning difficulties [16]	3b
	11. Material Selection: Avoid latex or allergenic dyes; combine with antimicrobial dressings for infected wounds [16, 20, 24]	3b
	12. Combined Therapy: Intermittent pneumatic compression (IPC) as adjunct with elastic bandages/stockings[29, 33]	2a
	13. Adjunctive Measures: Daily leg exercises (walking, resistance training), limb elevation (30 minutes/day), avoid prolonged sitting/standing; nutritional support (protein 1.25–2.00 g/(kg·d), vitamin C/zinc supplementation [17]	1a
	14. Patient Education: Proper donning/doffing techniques, skin care, and adverse effect recognition [16]	1a
	15. Routine Care: Daily skin cleansing (saline), moisturizing (hypoallergenic products), avoid alkaline cleansers [24]	1a
	16. Monitoring: Assess ulcer area reduction every 2 weeks; adjust regimen if <15% reduction after 6 weeks [14]	1a
Effectiveness	17. Benefits: Improved healing rate [24, 27, 29, 33]、shortened healing time [19, 24, 34]、pain relief in DVT within 24 hours [15, 18], enhanced quality of life [17, 21]	1a
Adverse Effects	18. Risks: Contact dermatitis, skin irritation, transient numbness, erythema; improper use may cause soft tissue damage, aggravated ischemia, or nerve injury [15, 21, 24]	1a

Note: ABI: Ankle-Brachial Index; CDT: Complete Decongestive Therapy; CEAP: Clinical-Etiology-Anatomy-Pathophysiology; DVT: Deep Vein Thrombosis; EVTA: Endovenous Thermal Ablation; IPC: Intermittent Pneumatic Compression; ISL: International Society of Lymphology; MRI/MRA: Magnetic Resonance Imaging/Magnetic Resonance Angiography; NYHA: New York Heart Association; PAD: Peripheral Arterial Disease; POSAS: Patient and Observer Scar Assessment Scale; QoL: Quality of Life; VTE: Venous Thromboembolism

8. CONCLUSION

This study summarizes 21 pieces of evidence in 7 aspects, including indications, contraindications, application, assessment, management strategies, effectiveness, and adverse reactions, related to the application timing and management strategies of compression therapy for chronic wounds. The results of this study indicate that compression therapy can be used as an adjunctive treatment for chronic wound management. Clinical practitioners should fully assess the application scope and timing of compression therapy and, based on the specific clinical context, consider the feasibility, appropriateness, clinical significance, and effectiveness of the evidence, and apply the evidence in combination with the patient's preferences to promote the healing of chronic wounds. Further high-quality research is still needed in the future to improve the quality of evidence and focus on the effect of compression therapy on patient-reported outcomes in chronic wound patients.

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