

WHAM Evidence summary: Managing lymphoedema: Compression therapy

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CLINICAL QUESTION

What is the best available evidence on the effectiveness of compression therapy for managing lymphoedema?

KEYWORDS

Lymphoedema, oedema, lymphatic system, compression therapy, compression bandaging, compression wrap, multi-layer bandaging, graduate hosiery, compression hosiery

SUMMARY

Compression therapy is considered the gold standard treatment for lymphoedema.¹ There is good evidence that compression therapy significantly reduces limb volume in individuals with lymphoedema, with effect commencing within hours of application of compression. There is also some evidence that compression therapy reduces pain and other symptoms (e.g. limb heaviness). Compression therapy in the form of short stretch (inelastic) multi-layer bandaging (MLB) is generally used in conjunction with other interventions as a component of complex lymphoedema therapy (CLT) to achieve initial reduction in limb volume.¹ Once significant limb volume reduction is achieved, compression hosiery is recommended for maintenance

therapy.¹ Selection of compression therapy should be based on the severity of disease and the individual's preferences and tolerance for therapy.

CLINICAL PRACTICE RECOMMENDATIONS

All recommendations should be applied with consideration to the wound, the person, the health professional and the clinical context:

Selection of compression therapy should be based on the severity of disease and the individual's preferences and tolerance for therapy. (Grade B)

Before applying compression therapy the individual's arterial status should be assessed by performing a comprehensive clinical assessment and an ABPI or TBPI. A vascular specialist should be consulted before applying compression therapy to an individual with an ABPI < 0.5. (Grade A)

Assessment should include checking for contraindications and conditions in which compression therapy should be used with caution. (Grade A)

Compression therapy should be applied at a sub-bandage pressure of at least 45mmHg for individuals with ISL stage II or greater lymphoedema. (Grade A)

Table 1: Sources of evidence and the level

Level 1 Evidence	Level 2 Evidence	Level 3 Evidence	Level 4 Evidence	Level 5 Evidence
Experimental Designs	Quasi-experimental Designs	Observational – Analytic Designs	Observational – Descriptive Studies	Expert Opinion/ Bench Research
1.b Systematic review of RCTs and other designs ^{2, 3} 1.c RCT ⁴⁻⁸	None	3.e Observational study without a control group ⁹⁻¹¹ 3. Qualitative study ³⁰	4.c Case series ¹²⁻¹⁴ 4.d Case report ^{15, 16}	5.b Expert consensus ^{1, 17} 5.c Expert opinion ¹⁸⁻²⁹

SOURCES OF EVIDENCE

This summary was conducted using methods published by the Joanna Briggs Institute.³¹⁻³⁴ This evidence summary is based on a structured database search using variations of the search terms describing lymphoedema and compression therapy. Searches were conducted in EMBASE, Medline, AMED and the Cochrane Library for evidence from 1990 to 2015 in English. Levels of evidence for intervention studies are reported in the table above.

BACKGROUND

Lymphoedema is a form of chronic, progressive oedema in which there is significant, persistent swelling of a limb or other body region due to excess and abnormal accumulation of protein-rich fluid in body tissues. This fluid contains a range of inflammatory mediators and adipogenic factors.^{1, 2, 18, 19, 27} The lymphatic system is unable to manage the volume of accumulated fluid.¹⁹

Lymphoedema occurs due to primary, secondary or mixed causes. Primary causes are described as congenital (e.g. an inherited disorder such as Milroy's disease), praecox (onset at puberty, e.g. Meige's disease) or tarda (sudden onset no apparent cause).^{17, 21, 25} Secondary causes arise from direct damage or trauma to the lymphatic system such as injury surgery or radiotherapy (usually related to treatment of breast cancer), or parasitic invasion.^{10, 17, 21} Lymphatic filariasis (also called elephantitis) is a cause of secondary lymphoedema endemic in areas primarily in Africa and Asia. Lymphatic filariasis is a parasitic (roundworm) infection that is spread by mosquitoes and causes damage to the lymphatic system that may result in lymphoedema. Infection generally occurs in childhood, although. Management focuses on large-scale treatment programs to reduce disease spread.²⁹ Mixed lymphoedema describes lymphoedema arising from decompensation or failure of the lymphatic system associated with other disease or conditions, including but not limited to obesity, immobility, venous disease or lipoedema.^{12, 17, 21}

Without management, lymphoedema may lead to:^{19, 26}

- progressive swelling,
- physical and functional limitations,
- chronic infection,
- fibrosis,
- lymphorrhoea (leaking of lymph fluid)

- pain and discomfort, and
- reduced ability to undertake activities of daily living (ADLs).

Compression therapy creates pressure differential (increase in interstitial fluid pressure) that reduces capillary filtration, increase microcirculation blood flow and facilitates interstitial fluid movement and lymph drainage, thereby reducing limb volume.^{5, 20}

Type of compression therapy

Compression therapy includes compression bandages, hosiery/garments and wrap-based systems. Intermittent pneumatic compression therapy, which provides similar therapeutic outcomes, is reported in a separate evidence summary.

Compression bandaging

Inelastic or short stretch bandages in two or more layers (multi-layer bandaging, MLB) with or without a padding layer are applied to limbs to create continuous low resting pressure. During walking or exercise, the bandages provide semi-rigid support against which muscles contract, creating high working pressure that enhances venous and lymph flow.^{22, 28} Multi-layer bandaging is generally used during the acute phase of lymphoedema²² and appears to be most effective when used as part of a comprehensive management plan that includes manual lymphatic drainage, exercises and skin care (a regimen known as complex lymphoedema therapy [CLT]). No studies with patients with lymphoedema were identified that investigated effectiveness of elastic bandaging.

Graduated or medical compression hosiery

Medical compression hosiery (or sleeves) are generally used for maintenance compression therapy to prevent re-accumulation of lymphatic fluid after reduction of limb swelling has been achieved with CLT and compression bandaging. They may also be used for individuals with mild lymphoedema. They come in a range of different compression strengths (measured in mmHg at the wrist or ankle) and lengths (e.g., below or above knee). Compression hosiery or sleeves should be selected according to the individual's needs and need to be fitted to the individual.^{23, 24} Compression hosiery should not be confused with non-medical 'support stockings' or 'anti-embolism' stockings, neither of which exert sufficient pressures to treat lymphoedema.²⁴

Wrap systems

Wrap systems may have advantages in the ease with which patients can self-apply the compression, attain equivalent interface pressures as healthcare professionals and make adjustments to the compression. Patients can be educated to tighten the compression system if it starts to feel loose, thereby promoting optimal interface pressures over longer wear times.⁵

CLINICAL EVIDENCE

Effectiveness in reducing oedema

A systematic review³ reported four trials that investigated compression therapy used in isolation of other interventions. Two of the studies reported significant moderate reductions in limb volume of 4 to 7% with compression bandaging. The reduction in oedema was also associated with reduction in symptoms including heaviness. However, there was no follow up period. Two studies reported effectiveness of compression garment with a pressure of 30 to 40 mmHg also found modest significant reduction in arm volume over two weeks over therapy.³ (*Level 1*).

A RCT⁵ conducted in patients with lower limb lymphoedema (n = 30) found that an adjustable inelastic compression wrap system was associated with a significantly greater reduction in limb volume compared with two-layer inelastic multicomponent compression bandaging after continuous 24 hour wear (10.3% reduction versus 5.9% reduction, $p < 0.05$)⁵ (*Level 1*).

An observational study⁹ reported a mean percentage reduction in limb size of 15.3% (range - 12.9% to 27.8%) for 24 individuals with upper or lower limb lymphoedema who wore a commercial two layer bandaging system for 19 days. The bandages were applied at full stretch and required replacing a mean 3.75 times/week. The reduction in limb volumes was significant for all limbs, both upper and lower. In this study 42% of individuals received concurrent manual lymphatic drainage (MLD) and 83% undertook exercise; however, concurrent MLD was not associated with improved limb reduction ($p = 0.89$)⁹ (*Level 3*).

Two RCTs^{6,7} have compared the same commercial two-layer bandaging system to different compression systems. In one of the RCTs⁶ the comparator was MLB that consisted of two layers of bandaging applied over synthetic cast wadding. Participants (n = 30) had

moderate to severe lower limb lymphoedema. After 24 hours of wear, both groups achieved significant reductions in median limb volumes (-8.4% for commercial system versus -4.4% for MLB, between group $p = \text{not significant}$)⁶ (*Level 1*). In the second RCT,⁷ the commercial two-layer bandaging system was compared to short stretch (inelastic) bandaging (number of layers unstated) for individuals with upper or lower limb lymphoedema. After 19 days treatment there was no significant difference in the mean reduction in limb volume, which ranged from 7.43% to 18.65% in lower limbs and 6.78% to 10.48% in upper limbs⁷ (*Level 1*). The study was insufficiently powered to determine significant findings.

An RCT⁴ compared MLB alone to MLB plus compression hosiery in individuals with unilateral upper or lower lymphoedema of at least 12 months (n = 83). After 24 weeks, participants using MLB plus hosiery achieved a mean reduction in limb volume of 32.6% (SD 33.2%), which was significantly greater ($p = \text{not reported}$) than the mean reduction of 19.6% (SD 28.5%) observed in the group wearing only hosiery. Significant reductions were also observed after 19 days and at weeks 7 and 12. The MLB intervention consisted of tubular stocking, retention bandage, foam padding and a minimum of two layers of short stretch (inelastic) bandage applied in a spiral, with the last layer applied in a figure eight. Customised compression hosiery was applied on top of the MLB⁴ (*Level 1*).

Numerous case reports^{15,16} and case series^{13,14} provide support for higher level studies regarding the efficacy of compression bandaging in attaining significant reduction in limb volume in individuals with upper and lower limb lymphoedema (*Level 4*).

Effectiveness of different sub-bandage interface pressures

An international clinical guideline¹ recommends that compression bandages are applied to achieve sub-bandage pressure of at least 45 mmHg for individuals with lymphoedema stage II or higher, or 15 to 25 mmHg in individuals who cannot tolerate higher pressure¹ (*Level 5*).

One RCT⁸ compared multicomponent short stretch (inelastic) bandages applied at low (20 to 30 mmHg) and high (44 to 58 mmHg) pressures in individuals with upper limb lymphoedema (n = 36). After two hours both groups had reduction in limb volume

(lower pressure -1.5% versus higher pressure -2.5% , $p =$ not significant), and no significant difference between groups was evident after 24 hours. The authors proposed that 30mmHg pressure is sufficient for upper extremities⁸ (Level 1).

Reduction in interface pressure of compression bandages occurs over time and reduces efficacy of treatment.^{5-7, 14} This may occur due to bandage failure, high reduction in limb volumes or poor application technique⁷

In one study,⁵ compression pressures of both a wrap system and two layer bandaging were significantly ($p < 0.001$) lower within two hours of initial application. Median interface pressures continued to decrease significantly over a 24 hour period for both compression systems⁵ (Level 1). In another trial,⁶ reductions in interface pressure after 24 hours of wear were noted for a commercial two layer bandaging system and standard MLB, with no significant difference in pressure reductions between the two compression therapy types⁶ (Level 1).

Effectiveness in reducing pain

An observational study⁹ ($n = 24$ individuals with upper and lower lymphoedema) reported a mean reduction in pain of 2.17 on a 10 point visual analogue scale (92% CI 0.66 to 3.67, $p = 0.007$) associated with a commercial two layer bandaging system. When an analysis was conducted based on clinical site, patients with lower limb lymphoedema experienced reductions in pain but there was no significant effect on pain for patients with arm lymphoedema⁹ (Level 3).

CONSIDERATIONS FOR USE

Cautions

Compression therapy should be used cautiously in individuals with arterial insufficiency ($ABPI < 0.5$) because it impedes blood flow to the limb.^{1, 20} Before commencing compression therapy comprehensive clinical assessment and an ankle brachial pressure index (ABPI) or toe brachial pressure index (TBPI) should be conducted to identify any arterial insufficiency.²⁰ Review by a vascular specialist and lower compression bandage pressure (15 to 25 mmHg) are recommended¹ (Level 5).

Compression therapy is contraindicated in individuals with decompensated heart failure because increase in blood return can exacerbate cardiac failure^{1, 20} (Level 5).

Compression therapy should be used with caution in individuals with severe peripheral neuropathy, acute deep vein thrombosis, diabetes, rheumatoid arthritis and acute cellulitis²⁰ (Level 5).

Adverse events

Participants in a qualitative study³⁰ found MLB restrictive, uncomfortable and stigmatising. Individuals reported a commercial two layer bandaging system as easier to apply, more flexible and maintained superior aesthetics over a number of days compared with standard MLB³⁰ (Level 3).

An observational study¹¹ involving women with post-surgery upper arm lymphoedema found significant reductions ($p < 0.01$) in grip strength and manual dexterity with MLB compared with a compression garment. Both compression types led to significant reduction in dexterity compared to no compression¹¹ (Level 3).

Discomfort, skin irritation, heat rash, anxiety, folliculitis, fibrosis, cellulitis, dyspnoea and neuralgia have been reported by small numbers of individuals receiving compression therapy.⁷ (Level 1).

CONFLICTS OF INTEREST

The author declares no conflicts of interest in accordance with International Committee of Medical Journal Editors (ICMJE) standards.

FUNDING

The author would like to acknowledge the support of the Australian Government's Cooperative Research Centres Program.

ABOUT WHAM EVIDENCE SUMMARIES

WHAM evidence summaries are consistent with methodology published in

Munn Z, Lockwood C, Moola S. The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach, *Worldviews Evid Based Nurs.* 2015;12(3):131-8.

Methods are provided in detail in resources published by the Joanna Briggs Institute as cited in this evidence summary. WHAM evidence summaries undergo peer-review by an international review panel. More information is available on the WHAM website: <https://www.whamwounds.com/>.

WHAM evidence summaries provide a summary of the best available evidence on specific topics and make suggestions that can be used to inform clinical practice. Evidence contained within this summary should be evaluated by appropriately trained professionals with expertise in wound prevention and management, and the evidence should be considered in the context of the individual, the professional, the clinical setting and other relevant clinical information.

PUBLICATION

This evidence summary has been published in *Wound Practice and Research*:

Haesler E. Evidence summary: Managing lymphoedema: Compression therapy. *Wound Practice and Research*, 2016; 24(4): 233-36.

REFERENCES

1. Lymphoedema Framework. Best Practice for the Management of Lymphoedema. London: MEP Ltd. 2006.
2. DiSipio T, Rye S, Newman B, Hayes S. Incidence of unilateral arm lymphoedema after breast cancer: a systematic review and meta-analysis. *Lancet Oncol*, 2013;14:500-15.
3. Moseley AL, Carati CJ, Piller NB. A systematic review of common conservative therapies for arm lymphoedema secondary to breast cancer treatment. *Ann Oncol*, 2007;18(4):639-46.
4. Badger CM, Peacock JL, Mortimer PS. A randomized, controlled, parallel-group clinical trial comparing multilayer bandaging followed by hosiery versus hosiery alone in the treatment of patients with lymphedema of the limb. *Cancer*, 2000;88(12):2832-7.
5. Damstra RJ, Partsch H. Prospective, randomized, controlled trial comparing the effectiveness of adjustable compression Velcro wraps versus inelastic multicomponent compression bandages in the initial treatment of leg lymphedema. *J Vasc Surg Venous Lymphat Disord*, 2013;1(1):13-9.
6. Lamprou DA, Damstra RJ, Partsch H. Prospective, randomized, controlled trial comparing a new two-component compression system with inelastic multicomponent compression bandages in the treatment of leg lymphedema. *Dermatol Surg*, 2011;37(7):985-91.
7. Moffatt CJ, Franks PJ, Hardy D, Lewis M, Parker V, Feldman JL. A preliminary randomized controlled study to determine the application frequency of a new lymphoedema bandaging system. *Br J Dermatol*, 2012. Mar;166(3):624-32.
8. Partsch H, Damstra RJ, Mosti G. Dose finding for an optimal compression pressure to reduce chronic edema of the extremities. *Int Angiol*, 2011;30(6):527-33.
9. Franks PJ, Moffatt CJ, Murray S, Reddick M, Tilley A, Schreiber A. Evaluation of the performance of a new compression system in patients with lymphoedema. *Int Wound J*, 2013;10(2):203-9.
10. Kim L, Jeon JY, Sung IY, Jeong SY, Do JH, Kim HJ. Prediction of treatment outcome with bioimpedance measurements in breast cancer related lymphedema patients. *Ann Rehabil Med*, 2011;35(5):687-93.
11. Kim S-J. Impact of the Type of Compression Materials on Manual Dexterity of Patients with Breast Cancer-Related Lymphedema (BCRL). *Journal of Physical Therapy Science*, 2012;24(10):969-73.
12. Greene AK, Grant FD, Slavin SA. Lower-extremity lymphedema and elevated body-mass index. *N Engl J Med*, 2012;366(22):2136-7.
13. Malou van Zanten B. Use of a two-layer compression system in severe bilateral leg lymphoedema with ulceration: A case report. *J Lymphoedema*, 2013;8(2):24-6.
14. Whitaker J, Williams A, Pope D, Elwell R, Thomas M, Charles H, Muldoon J. Clinical audit of a lymphoedema bandaging system: a foam roll and cohesive short stretch bandages. *J Wound Care*, 2015;24(3):83-4; 6-90; 2-4.
15. McGrath A. The management of a patient with chronic oedema: a case study. *Br J Community Nurs*, 2013;18(4 Suppl):S12-9.
16. Sheehan DD. Wound care management of a patient with stage III lymphedema. *Rehabil Nurs*, 2012;37(4):176-9.
17. International Society Of Lymphology. The diagnosis and treatment of peripheral lymphedema. Consensus document of the International Society Of Lymphology. *Lymphology*, 2013;46:1-11.
18. Armer J. The problem of post-breast cancer lymphedema: Impact and measurement issues. *Cancer Invest*, 2005;1:76-83.
19. Balci F, DeGore L, Soran A. Breast cancer-related lymphedema in elderly patients. *Top Geriatr Rehabil*, 2012;28(4):242-53.
20. Cooper G. Compression therapy and the management of lower-limb lymphoedema: the male perspective. *Br J Community Nurs*, 2015;20(3):118, 20, 22-4.
21. General Practice Divisions of Victoria. Lymphoedema: Guide for diagnosis and

- management in general practice. Melbourne: General Practice Divisions of Victoria, 2014.
22. Lasinski BB, McKillip Thrift K, Squire D, Austin MK, Smith KM, Wanchai A, Green JM, Stewart BR, Cormier JN, Armer JM. A systematic review of the evidence for complete decongestive therapy in the treatment of lymphedema from 2004 to 2011. *PM&R*, 2012;4(8):580-601.
 23. Lay-Flurrie K. Use of compression hosiery in chronic oedema and lymphoedema. *Br J Nurs*, 2011;20(7):418, 20, 22.
 24. Lim CS, Davies AH. Graduated compression stockings. *Canadian Medical Association Journal*, 2014;186(10):E391.
 25. Mayo Clinic staff. Diseases and Conditions: Lymphoedema. Available from: <http://www.mayoclinic.org/diseases-conditions/lymphedema/basics/causes/con-200256032014>.
 26. Renshaw M. Lymphorrhoea: 'leaky legs' are not just the nurse's problem. *Br J Community Nurs*, 2007;12(4):S18-21.
 27. Todd M. Chronic oedema: impact and management. *Br J Nurs*, 2013;22(11):623-27.
 28. Vowden K, Vowden P, Partsch H, Treadwell T. 3M™ Coban™ 2 Compression Made Easy. *Wounds Int*, 2011;2(1):1-6.
 29. World Health Organization. Lymphatic filariasis: Fact Sheet No 102. www.who.int/mediacentre/factsheets/fs102/en/: WHO, 2014.
 30. Morgan PA, Murray S, Moffatt CJ, Young H. The experience of patients with lymphoedema undergoing a period of compression bandaging in the UK and Canada using the 3M™ Coban™ 2 compression system. *Int Wound J*, 2011;8(6):586-98.
 31. Aromataris E, Munn Z, editors. *JBIM Manual for Evidence Synthesis*. <https://synthesismanual.jbi.global/>: JBI, 2021.
 32. Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party. *JBIM Grades of Recommendation*. https://jbi.global/sites/default/files/2019-05/JBI-grades-of-recommendation_2014.pdf: JBI, 2013.
 33. Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party. *JBIM Levels of Evidence*. https://jbi.global/sites/default/files/2019-05/JBI-Levels-of-evidence_2014_0.pdf: JBI, 2013.
 34. Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party. Supporting Document for the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation. <https://jbi.global/sites/default/files/2019-05/JBI%20Levels%20of%20Evidence%20Supporting%20Documents-v2.pdf>: JBI, 2014.