Postsclerotherapy compression: A systematic review

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ABSTRACT

Background: Compression after sclerotherapy is commonly used, although the evidence base for this practice is unclear. This study aims to summarize and assess the evidence for compression therapy after sclerotherapy to inform clinical practice.

Methods: A systematic review was performed according to PRISMA guidelines via Medline and EMBASE databases (1946 to December 31, 2019) by two reviewers. Full-text, English-language studies comparing compression type and/or duration in adult chronic venous disease patients undergoing liquid or foam sclerotherapy were included.

Results: Nine studies were identified: five using liquid sclerotherapy, three foam sclerotherapy and one using both. Studies had short follow-up periods (6-24 weeks) and reported on clinical outcomes, quality of life, side effects and complications. In C1 patients undergoing liquid sclerotherapy, any duration of stocking use significantly decreased telangiectasia and reticular vein number and size compared with no compression. No significant difference in clinical symptoms or quality of life was seen when comparing compression duration after liquid or foam sclerotherapy in tributary or truncal veins in C2 to C6 patients. Greater superficial vein resolution was seen with stockings compared with bandages in C2 patients undergoing liquid sclerotherapy to tributary veins. A comparison of stockings vs bandaging revealed differing thrombophlebitis rates but no significant difference in pigmentation. In C2 to C6 patients undergoing foam sclerotherapy, use of 35 mm Hg stockings significantly improved post-treatment symptoms compared with 23 mm Hg stockings. This review was limited by heterogeneity of outcome measurements and the variety of comparisons between compression types and durations.

Conclusions: Postsclerotherapy compression may have beneficial clinical outcomes at short-term follow-up; however, evidence is lacking regarding its type, class, length, and duration. Further trials are required to guide the optimal management of postsclerotherapy patients. (J Vasc Surg: Venous and Lym Dis 2020;■:1-11.)

Keywords: Sclerotherapy; Foam sclerotherapy compression therapy; Compression bandaging; Chronic venous disease

Sclerotherapy has been used in the treatment of chronic venous disease (CVD) In its liquid form for more than 160 years. Since the first treatments performed by Professors Pétrequin and Soquet,[1] sclerotherapy has evolved tremendously, with key developments including detergent sclerosants (eg, sodium tetradecyl sulphate) and foam sclerotherapy. Foam sclerotherapy has seen a revival in popularity and is among the recommended treatment options for tributary and truncal veins in international guidelines.[2-4]

Although compression after sclerotherapy is commonly included in trial protocols,[5-7] is widely thought to be beneficial and regularly provided in clinical practice,[8] there is a lack of a clear evidence base. It is unclear whether compression therapy applied after sclerotherapy truly has an impact on clinical and patient-reported outcomes. From an economic standpoint, regular provision of compression after sclerotherapy may represent an unnecessary expense and is an area of potential cost savings for patients and the healthcare service; it is estimated to cost up to £182 per patient per annum.[9]

Even if one assumes that compression is beneficial after sclerotherapy, there remains disagreement regarding the type (bandages or stocking), level, and duration of compressive therapy. Indeed, compression is often poorly tolerated, with a survey reporting only 29.1% of patients considering it to be "comfortable."[10] An extended duration of compression can also contribute to skin irritation, which may negatively impact on patients' quality of life, contrary to the intent of treatment. Compliance is a known challenge in the delivery of compression, with estimated adherence rates as low as 30%.[11,12] This systematic review aims to clarify the impact of compression therapy after sclerotherapy to provide evidence-based management for patients undergoing such procedures.

METHODS

A systematic review was performed according to the PRISMA guidelines.[13] The review protocol was prospectively registered on PROSPERO (ID: CRD42019145848).

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SEARCH STRATEGY

The Medline and EMBASE databases were searched from 1946 to December 31, 2019, using the following search algorithm:

(((((compression) OR compression bandag*) OR compression stocking))

AND

(((((varicose veins) OR reticular veins) OR telangiectasia) OR saphenous vein*) OR venous ulcer*))

AND

((sclerotherapy) OR foam sclerotherapy)

The literature search was performed using a systematic three step process. First, duplicates were excluded using a title screen. Second, once all duplicates were excluded, two reviewers (M.T., S.S.) independently performed an abstract screen to identify potentially relevant articles. The shortlists from both reviewers were then combined and any disagreements were discussed in person. Third, both reviewers performed a full-text screen of all shortlisted articles to ensure that they abided by the inclusion and exclusion criteria. References of the included articles were then searched to identify any other relevant articles. Any unresolved disputes were referred to a third reviewer (S.O.) for resolution.

INCLUSION AND EXCLUSION CRITERIA

Included studies were English-language, full-text articles comparing compression duration and/or type (eg, bandages, stockings) in adult patients undergoing either foam and/or liquid sclerotherapy for CVD reporting on clinical efficacy, complications, and patient-reported outcomes. Studies were excluded if they were nonprimary studies, case reports or case series.

DATA EXTRACTION

Data extracted included study design, inclusion and exclusion criteria of trials, compression parameters compared (type and duration), sclerosant used, patient and/or limb number treated, demographics (age, sex), CEAP clinical class, follow-up timepoints and key treatment outcomes in relation to compression parameters.

RISK OF BIAS ASSESSMENT

Randomized controlled trials (RCTs) were assessed using the Cochrane Risk of Bias Tool for Randomized Controlled Trials.[14] Nonrandomized studies were assessed using the ROBINS-I assessment tool.[15]

RESULTS

A total of 474 articles were identified from the literature search. Nine studies were identified meeting the inclusion and exclusion criteria[16-24] published between 1981 and 2019 (Fig). Seven were RCTs,[16-22] one was a controlled comparative study,[23] and one was a cohort study.[24] Five studies used liquid sclerotherapy,[16-19,23] three used foam sclerotherapy,[20-22] and the remaining study used both types of sclerotherapy.[24] Six studies included a total of 351 patients (range, 29-100 patients).[16,18-20,23,24] The remaining three studies did not report patient numbers, instead reporting on a total of 305 limbs (range, 84-124 limbs).[17,21,24] All studies included more females than males (percent female range, 59%-100%). Further study details can be found in Table I.

ARTICLE HIGHLIGHTS

- Type of Research: Systematic review
- Key Findings: Beneficial clinical outcomes of post-sclerotherapy compression at short-term follow-up, but evidence is lacking regarding type, class, length, and duration.
- Take Home Message: Further trials are required with standardization of comparisons and outcome measures.

RISK OF BIAS ASSESSMENT

No RCT was considered to be high risk for bias in this assessment. Overall risk was low for three RCTs,[16,18,21] although there were some concerns of bias in the remaining four studies.[17,19,20,22] In these four studies, concerns were raised in either the randomization process[17,20] or outcome measurements,[19,22] with only one domain of concern in each study. For the nonrandomized studies, one was deemed to be low risk[2] and one moderate risk.[24] The full risk of bias assessment can be found in Table II (for RCTs) and Table III (for non-RCTs).

COMPARISONS OF COMPRESSION PARAMETERS

Six studies compared compression duration[16,19-21,23,24] and three compression type.[17,18,22] The heterogeneity of comparison types and outcome measures precluded pooled analysis and a qualitative summary of study findings is provided elsewhere in this article.

Compression duration

Compression therapy, when applied, was used for a large range of durations (from 8 hours to 6 weeks;

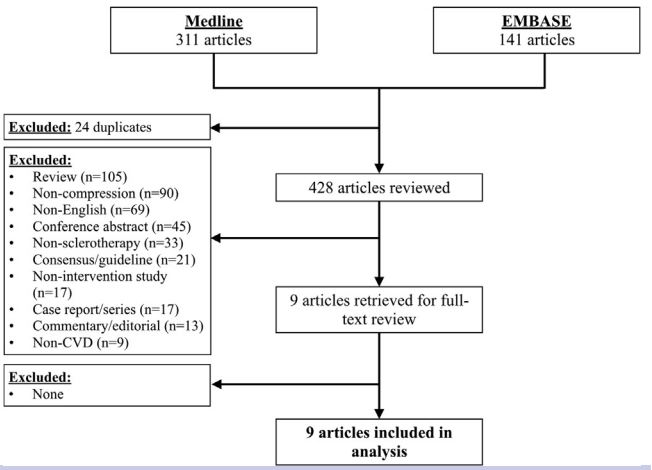

Fig. PRISMAdiagram showing the study selection process.

Table I. Study characteristics

Study, year, and design	Sclerosant used Comparisons and outcomes assessed	Inclusion/exclusion Patient/limb No.	Demographics CEAP class	Follow-up	Key outcomes
Weiss et al[23] 1999 Non-RCT	Sodium tetradecyl sulfate: - 0.5% for reticular veins (2-3 mm) - 0.2% for venulectases (1-2 mm) - 0.1% for telangiectases (<1 mm)	Inclusion: - C1 patients Exclusion: - GSV/SSV disease	Demographics not reported	1 week 2 weeks 6 weeks 12 weeks 24 weeks	Telangiectasia and reticular veins were treated Significantly decreased size and number of vessels with any duration of compression compared with no compression
	Compression 20-30 mm Hg stocking duration: no compression vs 3 days vs 1 week vs 3 weeks Outcomes: - Decrease in size and total no. of vessels - Side effects of treatment	All groups n = 10 Total: n = 40	All C1		Strong correlation between improvement and compression duration up to 24 weeks of follow-up Compression for 1 week and 3 weeks associated with less postsclerotherapy pigmentation
Raj and Makin[16] 1981 RCT	Sodium tetradecyl sulphate 3%	Inclusion: - Symptoms attributed to below knee varicose veins Exclusion: - Eczema - Ulceration	71% female (n = 71) Age not reported	6 weeks	Tributary varicose veins were treated Analysis was not intention to treat
	Compression bandaging (Crevic crepe, Tubigrip over bandages, pressure not reported) duration: 8 hours vs 6 weeks Outcomes: - Patient's view on cosmetic and symptomatic improvement - Operating surgeon's view on cosmetic improvement (degree of disappearance of veins) - Independent surgeon's view on cosmetic improvement - Infrared photographs to determine cosmetic improvement	112 patients recruited; 12 patients excluded due to noncompliance 6 weeks: n = 47 8 hours: n = 53 Total: n = 100 analyzed	All C2		No significant difference of treatment outcomes between groups
Scurr et al[17] 1985 RCT	0.5% ethanolamine	Inclusion: - C2 disease Exclusion: - SFJ incompetence - Very high thigh varicosities	78.6% female (n = 33): - Mean age 43.2 years, range 28-60 years 31.4% male (n = 9): - Mean age 52.6 years, range 42-69 years	3 weeks 6 weeks	Tributary varicose veins were treated More injections were considered successful with stockings vs bandages (92.3% vs 79.6%; $P < .001$)
	Compression type: bandaging (Elastocrepe, pressure not reported) vs 35-40 mm Hg stockings Outcomes: - Success of injections defined as complete disappearance of superficial veins at injection site - Thrombosis defined as presence of lump at injection site	Bandage: limb n = 42 Stocking: limb n = 42 Total: limb n = 84	All C2		More limbs were 100% successfully treated in stockinged vs bandaged legs (69.8% vs 50.0%; $P < .05$) Fewer limbs complicated by superficial thrombophlebitis in stockinged vs bandaged legs (44.2% vs 64.3%; $P < .05$) but no significant difference in postsclerotherapy pigmentation

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Table I. Continued.

Study, year, and design	Sclerosant used Comparisons and outcomes assessed	Inclusion/exclusion Patient/limb No.	Demographics CEAP class	Follow-up	Key outcomes
Shouler and Runchman[18] 1989 RCT	Sodium tetradecyl sulfate (concentration not specified)	Inclusion: - C2 patients Exclusion: - SFJ/SPJ incompetence	40 mm Hg: - 67.7% female - Mean age 39.3 years, range, 24-67 years 40 mm Hg + bandaging: - 77.4% female - Mean age 39.7 years, range 17-71 years	3-weeks 6-weeks	Tributary varicose veins were treated Reported underpowered for outcomes (required 250 patients per group at 10% level of difference) Similar number of patients removed stockings within the 6-week follow-up period (n = 18) Compression stockings alone was considered more comfortable than concurrent compression stockings and bandaging No significant difference in thrombophlebitis rate
	Compression type: 40 mm Hg stockings vs 40 mm Hg stockings + compression bandaging (Elastocrepe, pressure not reported) Outcomes: - Disappearance of treated vessels - If compression was uncomfortable, removed, or had slipped down - Thrombophlebitis rate	40 mm Hg: n = 31 40 mm Hg + bandaging: n = 31 Total: n = 62	All C2		
Kern et al[19] 2007 RCT	Not reported	Inclusion: - C1 patients Exclusion: - Declined participation - Previous sclerotherapy - Allergy to chrome - Reflux >1 second in deep veins, saphenous trunks, saphenous junctions, saphenous tributaries, or perforating veins	100% female Median age 47 years (range, 20-72 years)	6 weeks	Telangiectasia and reticular veins were treated Similar patient satisfaction measured on a visual analogue scale between the groups Objective efficacy assessment based on photographs analysis showed better outcomes with compression vs no compression (VAS 7.05 ± 1.7 vs 6.28 ± 2.1) Less prevalence of microthrombi in compression group vs no compression (10% vs 15.2%) with no other significant side effects SF-36 scores before and after treatment similar to that of the general population with no difference between groups
	Compression 23-32 mm Hg stocking duration: no compression vs 3 weeks Outcomes: - Clinical vessel disappearance rate - Discomfort of compression therapy - Side effects: microthrombi, pigmentation, matting - Quality of life determined using the SF-36	No compression: n = 49 3-weeks compression: n = 51 Total: n = 100	All C1		
Nootheti et al[24] 2009 Cohort	<1 mm veins: 2% glycerin mixed 2:1 with 1% lidocaine with epinephrine 1-3 mm veins: 0.25% sotradecol foam (1 mL solution with 4 mL of air) 3-6 mm veins: 0.5% sotradecol foam (1 mL solution with 4 mL of air)	Not reported	Demographics not reported	Between 7 and 8 weeks	Telangiectasia and reticular veins were treated Significantly higher post-sclerotherapy pigmentation in 1-week compression group ($P = .01$) but no difference in vein disappearance or superficial thrombophlebitis Higher proportion of swelling in 4-week compression group (45% vs 25%) but higher amount of bruising in 1-week compression group (15% vs 5%)
	Compression stocking duration: 30-40 mm Hg for 1 week vs 30-40 mm Hg for 1-week + 20-30 mm Hg for 3-weeks Outcomes: - Quality of life (instrument not reported) - Rate of vessel disappearance - Side effects: pigmentation, thrombophlebitis	1-week compression: limb n = 29 4-weeks compression: limb n = 29 Total: limb n = 58 (compared between both limbs of 29 participants)	All C1		

Table I. Continued.

Study, year, and design	Sclerosant used Comparisons and outcomes assessed	Inclusion/exclusion Patient/limb No.	Demographics CEAP class	Follow-up	Key outcomes
Hamel-Desnos et al[20] 2010 RCT	Aetoxisclérol (polidocanol)	Inclusion: - Symptomatic C2 to C6 patients - GSV ≤8 mm - SSV ≤6 mm - Reflux ≥1 second Exclusion: - Inability to provide informed consent - Isolated SFJ incompetence without saphenous trunk incompetence - Postsurgical recurrence of varices in GSV/SSV region without trunk recurrence - Comorbidities: chronic liver disease, kidney failure, ongoing malignancy, uncontrolled HTN, respiratory/cardiac failure, DVT history, known inherited/acquired coagulopathy, PFO - Pregnant/risk of pregnancy/nursing women - Alcohol intolerance or taking alcohol degradation blockers - Allergy to Lauromacrogol 400 or Lycra - Migraine/visual disturbance after foam sclerotherapy previously - Inability to apply elastic compression	91.7% female Median age 57 years (range, 32-78 years)	1 week 2 weeks 4 weeks	Saphenous trunks were treated Poor compliance to the compression regimen: - Mean 11 days worn - Only 40% wore compression every day All venous reflux was abolished with vein occlusion in both groups No significant difference between groups for patient reported outcomes (quality of life [CIVIQ-20], symptoms, satisfaction with sclerotherapy) and side effects Patients reported variable satisfaction with compression, with 50% reporting it to be effective to very effective
	Compression 15-20 mm Hg stocking duration: no compression vs 3 weeks Outcomes: - Ultrasound-assessed obliteration of venous reflux in the treated saphenous trunk at 28 days - Side effects: pain, thrombophlebitis, pigmentation, telangiectatic matting	No compression: n = 29 3 weeks of compression: n = 31 Total: n = 60	C2 to C6 (no. of patients in each class not reported)		

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Table I. Continued.

Study, year, and design	Sclerosant used Comparisons and outcomes assessed	Inclusion/exclusion Patient/limb No.	Demographics CEAP class	Follow-up	Key outcomes
O'Hare et al[21]) 2010 RCT	Sodium tetradecyl sulphate 3% Compression bandaging (Peha-haft, pressure not reported) duration: 24 hours vs 5 days Outcomes: - Quality of life determined using the Aberdeen Varicose Vein Severity Score and SF-36 - Buford pain score - Ultrasound-assessed vein occlusion rate - Side effects: phlebitis scores	Inclusion: - Superficial venous reflux >1 second in the GSV/SSV/anterior accessory saphenous vein/major tributary with proximal incompetent deep venous connection - Expressed preference for foam sclerotherapy over surgery Exclusion: - Total deep venous reflux on duplex - Peripheral arterial disease (ABPI of <0.9) - Pregnancy or breastfeeding - Known allergy to sclerosant 24-hours: limb n = 61 5-days: limb n = 63 Total: limb n = 124	24 hours: - 59.0% female - Mean age 60 (range, 31-82 years) 5 days: - 63.5% female - Mean age 59 (range, 27-81 years) C2: n = 57 C3: n = 11 C4: n = 30 C5: n = 26	2 weeks 6 weeks	Saphenous trunks were treated 2-Week review: - No significant difference in number of target veins successfully occluded shown on hand-held Doppler - No significant difference in change in AVVQ scores - No significant difference in change in Burford pain scores 6-Week review: - No significant difference in number of target veins successfully occluded - Although both groups showed statistically significant improvement in AVVQ scores, there was no significant difference in change in AVVQ scores between groups - Statistically significant change in Burford pain scores for the 24-hour compression group, but not the 5-day compression group
Cavezzi et al[22] 2019 RCT	Sodium tetradecyl sulphate 3% Fibrovein CO_2/O_2 1:4 ratio Compression type: 23 mm Hg stockings vs 35 mm Hg stockings (for 7-days, then 21-23 mm Hg stockings in the daytime) Outcomes: - VAS assessment of symptoms: pain, burning sensation, dysesthesias, heaviness, itching, ambulation, tolerability, stability - Compression compliance - Skin signs/findings: ecchymosis, hematomas, dermo-hypodermitis, skin healing, skin blisters, pigmentation	Inclusion: - Primary lower limb varicose veins related to GSV incompetence or SFJ terminal valve incompetence - Referred for foam sclerotherapy of GSV + phlebectomies of varices Exclusion: - Severe peripheral arterial disease (ABPI of <0.5) - BMI of >35 23 mm Hg: limb n = 48 35 mm Hg: limb n = 49 Total: limb n = 97	23 mm Hg: - 65.2% female - Mean age 55 years 35 mm Hg: - 60.4% female - Mean age 52 years C2: n = 60 ≥C3: n = 37	3 days 7 days 40 days	Saphenous trunks were treated (together with concomitant phlebectomy of varicose tributaries) Symptoms significantly better with 35 mm Hg compression stockings at 3, 7, and 40 days postoperatively: - Pain (3 days $P = .00$, 7 days $P = .01$, 40 days $P = .02$) - Burning sensation (3 days $P = .02$, 7 days $P = .00$) - Dysesthesias (3 days $P = .04$) - Heaviness (3 days $P = .01$, 7 days $P = .01$) All patients were compliant with the compression therapy 35 mm Hg compression leads to significantly better ambulation (P = .04) and is more tolerable at 3 days (P = .04) Overall better, but nonsignificant, skin healing with 35 mm Hg compression

ABPI, Ankle-brachial pressure index; *AVVQ,* Aberdeen Varicose Vein Questionnaire; *CIVIQ-20,* 20-item Chronic Venous Disease quality of life Questionnaire; *DVT,* deep vein thrombosis; *GSV,* great saphenous vein; *HTN,* hypertension; *PFO,* patent foramen ovale; *RCT,* randomized, controlled trial; *SF-36,* Short Form-36; *SFJ,* saphenofemoral junction; *SPJ,* saphenopopliteal junction; *SSV,* short saphenous vein; *VAS,* visual analogue score.

Table II. Risk of bias assessment for randomized, controlled trials using the Cochrane Risk of Bias 2 assessment tool

Study	Randomization process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall
Cavezzi et al[22]	+	+	+	?	+	!
Hamel-Desnos et al[20]	?	+	+	+	+	!
Kern et al[19]	+	+	+	?	+	!
O'Hare et al[21]	+	+	+	+	+	+
Scurr et al[17]	?	+	+	+	+	!
Shouler and Runchman[18]	+	+	+	+	+	+
Raj and Makin[16]	+	+	+	+	+	+

Low risk- +.
Some concerns- ?.
High risk- —.
Some concerns- !.

Table I provides specific comparisons). Within these studies, compression type differed, with two studies using bandages[16,21] and four using various grades of compression stockings.[19,20,23,24]

Compression type

Compression type was only compared in patients with C2 to C6 disease, with two studies including C2 patients alone.[17,18] Again, comparisons differed between all three studies (Table I).

Clinical outcomes

Class C1. Compression duration was assessed in three studies.[19,23,24] Improved clinical outcomes were described in two studies.[19,23] A non-RCT reported that any duration of compression, ranging from 3 days to 3 weeks, resulted in significantly decreased size and number of telangiectasia and reticular veins compared with patients having no compression.[23] Similar results were observed in an RCT,[19] where expert assessment using photographs reported superior clinical improvement, with higher visual analogue scale scores indicating greater vessel disappearance with compression compared with no compression (7.05 ± 1.7 vs 6.28 ± 2.1; $P = .026$). However, a cohort study reported no significant difference in vein disappearance between 1 and 4 weeks of compression,[24] which may suggest that longer compression durations may not have additional clinical benefits.

Studies also observed the impact of compression duration on side effects related to sclerotherapy, but findings between studies were not consistent. Compression of 20 to 30 mm Hg used for 1 and 3 weeks after liquid sclerotherapy for telangiectasia and reticular veins resulted in a decrease in pigmentation compared with no compression,[23] In a separate study, patients undergoing liquid sclerotherapy were made to wear compression (30-40 mm Hg) stockings bilaterally for 1 week, after which one limb had no stocking and the other wore a class I (20-30 mm Hg) stocking for an additional 3 weeks. This

Table III. Risk of bias assessment for nonrandomised studies using the Cochrane ROBINS-I assessment tool

Bias owing to confounding									
Study	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	Risk of bias judgement
Nootheti et al[24]	PN	NA	NA	NA	NA	NA	NA	NA	Low
Weiss et al[23]	PN	NA	NA	NA	NA	NA	NA	NA	Low
Bias in selection of participants into the study									
Study	2.1	2.2	2.3	2.4	2.5				Risk of Bias Judgement
Nootheti et al[24]	N	NA	NA	Y	NA				Low
Weiss et al[23]	N	NA	NA	Y	NA				Low
Bias in classification of interventions									
Study	3.1	3.2	3.3						Risk of Bias Judgement
Nootheti et al[24]	Y	Y	N						Low
Weiss et al[23]	Y	Y	PN						Low
Bias owing to deviations from intended interventions									
Study	4.1	4.2							Risk of Bias Judgement
Nootheti et al[24]	NI	NA							No information
Weiss et al[23]	N	NA							Low
Bias owing to missing data									
Study	5.1	5.2	5.3	5.4	5.5				Risk of Bias Judgement
Nootheti et al[24]	PY	PN	PY	NI	PY				Moderate
Weiss et al[23]	PY	PN	PN	NA	NA				Low
Bias in measurement of outcomes									
Study	6.1	6.2	6.3	6.4					Risk of Bias Judgement
Nootheti et al[24]	PY	PY	Y	PN					Moderate
Weiss et al[23]	PY	NI	Y	PN					Moderate
Bias in selection of the reported result									
Study	7.1	7.2	7.3						Risk of Bias Judgement
Nootheti et al[24]	N	N	N						Low
Weiss et al[23]	PN	PN	PN						Low
Study	Overall bias								
Nootheti et al[24]	Moderate								
Weiss et al[23]	Low								

N, No; *NA*, not applicable; *NI*, no information; *PN*, probably no; *PY*, probably yes; *Y*, yes.

study showed significant reduction in postsclerotherapy pigmentation with the additional 3 weeks of compression, with reduction in bruising and swelling noted as well.[24] A further study reported no difference between compression and no compression groups in postsclerotherapy pigmentation; however, in the compression group, there was a statistically significant decrease in the presence of thrombi on clinical examination.[19]

Compression duration. The results were less positive for patients in CEAP clinical class C2 to C6, with one study treating varicose tributaries with liquid sclerotherapy as the primary operation[16] and two studies using foam sclerotherapy to treat saphenous trunks.[20,21] An early RCT, while performing a per-protocol analysis, showed no clinical difference between 8 hours and 6 weeks of compression bandaging after treating varicose tributaries in patients with C2 disease.[16] This finding was consistent with results from more recent RCTs.[20,21] One RCT compared 24 hours and 5 days of four-layer compression bandaging (pressures attained not reported), showing no difference in successful occlusion of target truncal veins between groups at both 2 and 6 weeks of follow-up.[21] In a further RCT, patients were randomized to either wearing 15 to 20 mm Hg stockings for 3 weeks or no compression after foam sclerotherapy of saphenous trunks. Again, all target veins were shown on Duplex ultrasound examination to be occluded in both groups. However, it must be noted that there was poor patient compliance with compression therapy reported for various reasons, including discomfort, pain, itching, and irritation. Only 40% of patients wore the stockings every day, wearing them for a mean of 11 days out of the scheduled 21 days, and this lack of compliance may have affected the results.[20]

Compression types. Two early RCTs used liquid sclerotherapy in the treatment of tributary veins in C2 patients.[17,18] One study compared two-layer bandaging with 35 to 40 mm Hg stockings, showing a statistically significant difference in clinical success rates (defined as disappearance of the vein at the injection site) and decreased thrombophlebitis rates with stockings (42.9% vs 64.4%),[17] although venous thromboembolism rates were not reported. The other RCT reported no significant difference in thrombophlebitis rates when comparing stockings vs stockings plus bandages, with patients preferring compression stockings alone to the combination of stockings and bandages. Pressures attained by this combination were not reported, and this study was also reported to be underpowered for the clinical outcomes.[18]

The most recently published RCT performed foam sclerotherapy on the saphenous trunks of C2 to C6 patients, together with concomitant phlebectomies.[22] Patients were randomized to either 23 mm Hg or 35 mm Hg stockings for 7 days, after which all patients wore 21 to 23 mm Hg stockings in the daytime for the remaining 33 days. At all follow-up points up to 40 days, symptoms such as pain, dysesthesia, and heaviness were all significantly improved in the higher grade stocking group. However, although there was a trend for improved skin healing of concomitant phlebectomy wounds with the 35 mm Hg stockings, this difference did not reach statistical significance.

Patient-reported outcome measures

Patient-reported outcome measures were reported in three studies.[19-21] The Aberdeen Varicose Vein Questionnaire was used in one study to determine changes in quality of life, but showed no significant difference at 2 and 6 weeks between patients undergoing 24 hours or 5 days of compression.[21] Similarly, there were no significant differences between the 20-item Chronic Venous Disease quality of life Questionnaire scores between patients having no compression or 3 weeks of compression with 15 to 20 mm Hg stockings,[20] as well as no differences in Short Form-36 scores for C1 patients having no compression vs 3 weeks of wearing 23 to 32 mm Hg stockings.[19]

Patient satisfaction was similar, and comparable with general population norms, for patients undergoing 8 hours vs 6 weeks of compression,[19] although variable patient satisfaction with compression therapy was reported in a separate RCT, with only 50% considering it to be effective or very effective.[20]

DISCUSSION

This review summarizes the existing evidence pertaining to the use of compression after both liquid and foam sclerotherapy. The main finding is that compression may have a positive impact on clinical outcomes, including postoperative complications (eg, pain, swelling, bruising) and healing (including concomitant skin wounds eg, phlebectomies). This finding is consistent with findings for compression after other modes of intervention, including endovenous thermal ablation[25] and surgery.[26] The benefit of compression postsclerotherapy is more evident for C1 disease, with weaker evidence for benefit in C2 to C6 CVD. The strength of these conclusions, however, is further limited by the heterogeneity of comparisons and outcome measures and the low quality of included studies; in addition, the evidence largely pertains to short-term follow-up. There is also little evidence to suggest the benefit of one type of compression over the other.

The findings of this review are consistent with European and recently published international guidance, which both recommend that compression may be applied after sclerotherapy to improve outcomes.[27,28] This recommendation is, however, deemed by both guidelines to be weak (Grade 2C). Additionally, there remains ambiguity regarding the duration of compression and no clear guidance regarding the superiority of any type or grade of compression.

Postinterventional compression, be it in sclerotherapy or other treatment modalities, is intended to exert pressure on the skin and subcutaneous tissues, reducing reflux and helping prevent thrombus formation.[29] To narrow vessel lumina, compression pressures must closely approximate or exceed intravascular pressures—the required pressures have been reported to range from 70 mm Hg in the calf veins to 40 mm Hg in thigh veins as measured using duplex ultrasound measures[30-33]; lower pressures may be required for smaller reticular veins. In this review, all studies using compression bandaging failed to report on pressures attained, nor were any methods proposed to explore this parameter (eg, pressure monitors,[34] bandages with geometric designs to indicate adequate pressures attained[35]), making it difficult to assess the effect of specific pressures on clinical outcomes. It would be interesting to see if adequate pressures were achieved and if this had an impact on the results seen in the current literature.

In this review, a number of studies reported on compliance.[20,22] This factor was variable, ranging from poor[20] to good,[22] with poor compliance secondary to discomfort and irritation arising from the compression therapy. All other studies failed to report on compliance rates or techniques used to improve patient compliance. It is, therefore, difficult to determine whether this parameter had a substantial impact on the results in the individual studies and the disparity of outcomes between C1 and C2 to C6 patients observed in this review. It is well-documented in the literature that compression regimens can only have a positive impact when patients comply—a systematic review on compression in venous ulcers showed that recurrence rates were 2 to 20 times higher when patients failed to comply with compression

use.[36] This finding has, however, been shown to be difficult to achieve. A meta-analysis on interventions to improve compliance reported that adherence can range between 10% and 80%,[37] with a systematic review showing inferior compliance in patients given higher levels of compression.[38] To truly determine the impact of compression treatment after sclerotherapy, future studies must consider measures to monitor and enhance patient compliance. Much of the literature on this subject focusses on patients with venous ulceration, but the principles apply—interventions include counselling, reminders through text messages or other means, timely pressure measurements to ensure specific compression levels are being maintained, and while potentially subject to bias, compression diaries.

Finally, the studies included in this review have focused mainly on clinical outcomes, usually defined as the disappearance or occlusion of reticular or varicose veins or the resolution of symptoms experienced by patients. In CVD, another important parameter is recurrence—the short follow-up in these studies (ranging from 3-week to 6-month periods) precludes assessment. Recurrence in sclerotherapy is common, with a recent meta-analysis reporting a recurrence rate of 29% at the 5-year follow-up.[39] Although the mechanisms of recurrence are still debatable,[40] it would be interesting to assess whether compression has an effect on recurrence rates.

CONCLUSIONS

Current evidence suggests that, clinically, compression therapy improves vessel disappearance and decreased side effects after sclerotherapy, but fails to have an impact on quality of life. Presently, extended compression with stockings after sclerotherapy for C1 disease seems to have a stronger evidence base than that for C2 to C6 disease. There are, however, insufficient data to recommend a specific compression duration, nor is there enough evidence to determine the superiority of one type of compression over another. Further research should build on the current literature—there is a need to identify and standardize comparisons as well as outcome measures across studies to allow for potential meta-analysis in future reviews. Studies should also ideally measure and report actual pressures achieved with bandages or stockings, if these pressures changed over the duration of the study and any measures to monitor the pressure delivered, the compliance and potentially characterize the impact of these variables on clinical and quality-of-life outcomes.

AUTHOR CONTRIBUTIONS

Conception and design: MT, SO, AD
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