Compression after sclerotherapy for telangiectasias and reticular leg veins: A randomized controlled study

Philippe Kern, MD,[a] Albert-Adrien Ramelet, MD,[b] Robert Wütschert, MD,[c] and **Daniel Hayoz, MD,[d]**
Vevey, Lausanne, and Neuchâtel, Switzerland

Background: **The efficacy of wearing compression stockings on clinical vessel disappearance following sclerotherapy of telangiectasias and reticular veins has been a matter of debate for half a century.**
Objective: **To determine the relative efficacy of compression following sclerotherapy and to determine its impact on general quality of life in a prospective randomized open-label trial.**
Methods: **Female patients seeking treatment of telangiectasias and reticular veins and presenting comparable areas of telangiectasias on the lateral aspect of the thigh ($C_{1A\ or\ S}E_PA_{S1}P_N$) were randomized to wear medical compression stockings (23 to 32 mm Hg) daily for 3 weeks or no such treatment following a single session of standardized liquid sclerotherapy. Outcome was assessed by patient satisfaction analysis and quantitative evaluation of photographs taken from the lateral aspect of the thigh before and again at 52 days on the average after sclerotherapy by two blinded expert reviewers. Patients completed a quality of life questionnaire (SF-36) before treatment and again at the control.**
Results: **Data of 96 of 100 randomized patients could be evaluated. Patient satisfaction with the outcome of treatment was similar in the two groups. Objective assessment of clinical vessel disappearance revealed a benefit of wearing stockings ($P = .026$) corresponding to a NNT (number needed to treat) of 4.7 patients to get a vessel disappearance score higher than 6. The interobserver agreement was very high (intraclass correlation coefficient = 0.93). Compression was well tolerated with a low rate of discomfort claims (mean 17.5%). Micro-thrombi were rarely observed in either group, but still less prevalent in the compression group. The rate of pigmentation and matting was low and did not differ significantly between the two groups. Physical and mental quality of life scores in women seeking treatment of telangiectasias were similar to those of a healthy control population. Treatment had no impact on general quality of life.**
Conclusion: **Wearing compression stockings (23 to 32 mm Hg) for 3 weeks enhance the efficacy of sclerotherapy of leg telangiectasias by improving clinical vessel disappearance. (J Vasc Surg 2007;45:1212-16.)**

The use of compression following sclerotherapy for telangiectasias and reticular veins varies much between different countries.[1] In France, Canada, and Italy, only a minority of phlebologists apply compression after sclerotherapy for telangiectasias, while it is routinely used in Switzerland and Germany.[1,2] The duration of compression varies between 24 hours and more than 3 weeks. The compression modality includes medical compression stocking (20 to 40 mm Hg)[2-8] and various forms of compression bandages.[2,3,5] Some phlebologists use local exocentric compressive pads in addition.[3,4] In recent trials, postsclerotherapy compression varied from no compression[9] to 72 hours compression for telangiectasias[4,8] and 1 week for reticular veins.[5,6,8]

Effectiveness was shown for telangiectasias greater than 0.5 mm diameter[4] and the best effect observed in patients wearing compression stocking (20 to 30 mm Hg) for 3 weeks.[7] A certain benefit of compression was already observed after 3 days and 1 week.

Compression is thought to enhance the efficacy of sclerotherapy by reducing the formation of postsclerotherapy thrombi, as well as pigmentation and matting by minimizing inflammation and angiogenesis.[10] However, medical compression stockings (20 to 30 mm Hg) do not allow compression of the lower limb veins in the standing position.[11] For telangiectasias, 80 mm Hg compression pressure is required to produce a complete emptying of blood as the patient is standing.[10] At the thigh, compression stockings exert only 41% to 74%[10] from the compression of the ankle, therefore, 23 to 32 mm Hg compression stockings, apply approximately only 10 to 18 mm Hg at the thigh. For this reason, efficacy of applying compression stockings after sclerotherapy of telangiectasias of the thigh is debatable.

The great diversity of methods reflects personal experience and a lack of evidence to propose postsclerotherapy compression.

Patients are often reluctant to use compression therefore, it is mandatory to assess its efficacy to convince the patients to wear his compression stockings after sclerotherapy.

This study was designed to evaluate if wearing compression stockings after sclerotherapy of telangiectasias as well as their feeding reticular veins can enhance clinical

Private offices of vascular medicine in Vevey[a], Lausanne[b], and Neuchâtel[c], and Department of Angiology,[d] CHUV.
Competition of interest: none.
Ganzoni & Cie AG, St.Gallen, Switzerland, provided the compression stockings, but did not interfere with the design or the interpretation of the study results.
Correspondence: Philippe Kern, MD, 29, rue de la Madeleine, CH-1800 Vevey, Switzerland (e-mail: phkern@bluewin.ch)
0741-5214/$32.00

doi:10.1016/j.jvs.2007.02.039

Table I. Outcome parameters: assessment method and statistics used, respective to each outcome

	Outcome	*Assessment method*	*Statistics*
Main outcome	Clinical vessel disappearance	Objective assessment through blinded analysis of photographs by two experts	Student *t*-test
		Patient satisfaction reported on an analogue visual scale	Student *t*-test
Secondary outcomes	Side effects	Identification of side effects by the treating physician was matched with side effects reported from the photographic analysis by blinded experts	χ^2 tests
	Tolerability of wearing stockings	Visual analogue scale	Mean, median, STD
	Effect of wearing stockings on general quality of life	Quality of life questionnaire SF-36	ANOVA model

ANOVA, analysis of variance

vessel disappearance including its impact on general quality of life. The study was not intended to analyze the role of the vessel size in outcome since such data have been provided before.

METHODS

Patients. One hundred consecutive, female patients with primary telangiectasias and reticular veins on the lateral aspect of the thigh ($C_{1A\text{ or }S}E_PA_{S1}P_N$) were included in the study between September, 2003 and September, 2005 in a private office of vascular medicine. The study was approved by the ethics committee of the Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland. Patients signed consent after full information. All patients underwent a clinical examination and color-flow duplex imaging (CFDI) of their veins. They were devoid of reflux lasting more than 1 second in the deep veins, saphenous trunk, saphenous junction, saphenous tributaries, or perforating veins. All had fully compressible deep and superficial veins. Further exclusion criteria were previous sclerotherapy and allergy to chrome. By design, we only considered patients with aesthetic problems and normal duplex who sought treatment for the first time. As no patient declined participation, and no patient reported allergy to chrome, no patient was excluded from the study.

Main outcome of the study was the clinical vessel disappearance rate (Table I).

The sample size required for this trial was calculated on the basis on our previous sclerotherapy study, which compared different sclerosing agents,[5] as it was not possible to perform a power calculation on the previous compression study either because of the lack of statistics or a different statistical methodology. In our previous sclerotherapy study,[5] a statistical significant difference between sclerosing agents could be demonstrated, therefore, it was possible to perform a power calculation for this study since the methodology is similar. Precalculation of the sample required size showed that to detect a true difference of half a standard deviation at a one sided 5% significance level with a power of 80%, exactly 100 patients are required, 50 in each group. Median age of participants was 47 years (range 20 to 72).

Procedure. The study was designed as a prospective randomized open-label trial. To have comparable skin area treated, without any influence of a potential saphenous reflux, only telangiectasias located on the lateral aspect of the thigh were considered for the study. The patients had comparable types and sizes of telangiectasias and reticular veins: the diameter of reticular veins ranged between 1 to 2.9 mm, that of telangiectasias between 0.2 and 1 mm. These vessels could be identified from a distance of 2 meters by the human eye and the camera.

One lower limb per patient was treated in a single session. If both thighs were affected, only the left one was treated and evaluated for the study as defined by the protocol.

Prior to treatment, each patient was randomly assigned (computer generated random table) either to no compression or to compression for 3 weeks following sclerotherapy. The whole treated thigh area was photographed immediately before sclerotherapy in supine position in order to avoid arbitrary selection of a limited skin surface. The same digital camera (Coolpix 990, Nikon, Tokyo, Japan), lighting conditions (flash), and focal distance were used. Chromated glycerin (Scleremo, Laboratoires Bailleul, Paris, France) was used in all patients as the sclerosing agent as previously described.[5]

Injections were performed with a 2 ml silicone syringe and a 30 G ½-inch needle with the patient in supine position. Sixty to 100 injections were made on the lower limb during the session. The maximum amount of sclerosing solution injected was 10 ml per patient. Reticular feeding veins were injected prior to injection of the telangiectasias. Patients remained supine for 5 minutes after the last injection. In the compression group, a thigh-length stocking Sigvaris 702 Top Fine (23 to 32 mm Hg) was applied respecting the individual lower limb dimensions. Patients were asked to wear the compression stockings daily for 3 weeks and to remove it during night time. Patients filled in a quality of life questionnaire (SF-36[12]) prior to treatment.

Assessment. Patients were scheduled 6 weeks after treatment. They were questioned about their satisfaction using a visual analogue scale ranging from bad perception (0) to great satisfaction (100). Patients in the compression group were questioned about any discomfort produced by wearing compression hosiery (0 excellent tolerability to 100 high discomfort), and compliance. Compliance with

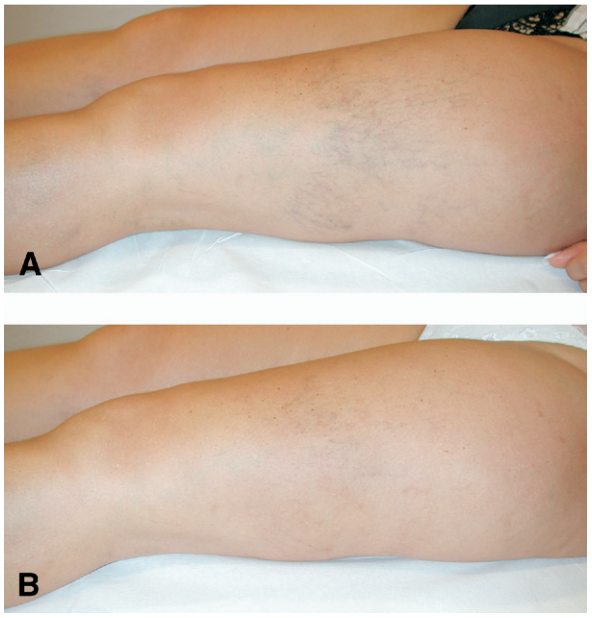

Fig 1. Example of a patient pretreatment (**A**) and 46 days after (**B**) control photographs with the respective experts blinded vessel disappearance score. Evaluation: vessel disappearance score expert one: 8, expert two: 9.

wearing stockings was not quantified by any scientific means. The SF-36 questionnaire was again completed.

A control photograph was taken under the conditions set for the pretreatment assessment. Two independent blinded experts analyzed the photographs using a visual "a priori" score of vessel disappearance. A score of 0 meant no improvement, whereas a score of 10 indicated complete vessel disappearance (Fig 1). The experts also evaluated possible side effects using a similar score. Both reviewers were experts in phlebology, with extensive experience with sclerotherapy. The assessment method had been validated in a previous study[5] performed in collaboration with the same experts, where it showed to have a high inter-observer agreement as well as a good reproducibility. The experts analyzed the global area of the photograph and not only a section of it. This method avoids selecting arbitrarily a small area and has the advantage that treatment result is not influenced by external factors such as feeding veins and new variables like the choice of a very limited area. After calculating the interobserver reliability, the mean score of the ratings of the two experts was used for further analysis.

The treating physician, not blinded to the treatment, checked for side effects reported by the patients. He also identified micro-thrombi, pigmentations, or matting, as they may be difficult to evaluate on the photographs.

Statistics. Power calculation was performed using the Java Application of Lenth R.V. 2006. Student *t* test with a level of significance of $P < .05$ was used to analyze patient age, the time interval to the control picture, satisfaction graded by the patient, and the efficacy score determined by the experts. With the hypothesis that compression ought to be better than no compression, outcome related statistical tests were performed one tailed. The interobserver agreement on the photographs was analyzed by intraclass correlation coefficient. In order to compare different outcome groups, the patients were divided into tertiles related to the vessel disappearance score. To calculate commonly used measures of therapeutic effect (absolute and relative risk reduction (ARR, RRR), number needed to treat (NNT) the lowest third of the vessel disappearance score (score 1 to 6) was defined as unfavorable. Potential differences of side effects were analyzed by χ^2 tests. The influence of the treatment on SF-36 was calculated with an analysis of variance (ANOVA) model. Pearson correlation coefficients were calculated between the different variables.

RESULTS

Evaluation of the photographic images. Analysis of the photographs using the vessel disappearance score revealed a very good agreement between the two independently working blinded reviewers (intraclass correlation coefficient = 0.93).

Efficacy. One hundred patients were randomized, 49 in the group without compression (WCG) and 51 in the group with compression (CG). Three patients of the WCG and one patient in the CG did not return for control. Therefore, 96 patients were included for the final efficacy analysis: 46 in the WCG and 50 in the CG.

There were no differences between the two groups for age and the time that elapsed until the postsclerotherapy photograph was taken. Time interval to control was 53.5 (+/- 22) days in the no compression group and 50.6 (+/- 17) days in the compression group. Four patients were controlled before 35 days (minimum 30 days), and four other patients missed their appointment and came back to the control more than 100 days (maximum 151 days) after the intervention. A statistical analysis excluding the patients controlled before 5 weeks and after 7 weeks (23 excluded in the WCG, and 13 in the CG), showed no difference in the results. Indeed, the significant difference of the mean expert score was higher in favor of compression treatment, and furthermore, it did not change the results of the quality of life analysis. Therefore, we decided not to exclude these patients from the final analysis.

Patient satisfaction was the same in either group: 75.3 (+/- 20.6) for the WCG and 77.3 (+/- 18.1) for the CG (not significant, ns).

Objective assessment of the result by the experts revealed a significant benefit of compression therapy. The mean score was 6.28 (+/-2.1) for the WCG and 7.05 (+/- 1.7) for the CG ($P = .026$). Although patient satisfaction revealed no significant difference between the two treatment modalities, there was a significant positive correlation with the mean expert score ($r = .21$, $P < .05$). Vessel disappearance score analysis (Fig 2) showed that 43% of the patients wearing no compression and only 24% of the patients wearing compression had a less favorable outcome (vessel disappearance score 1 to 6). On the other hand, 76% of patients wearing compression had a satisfying outcome

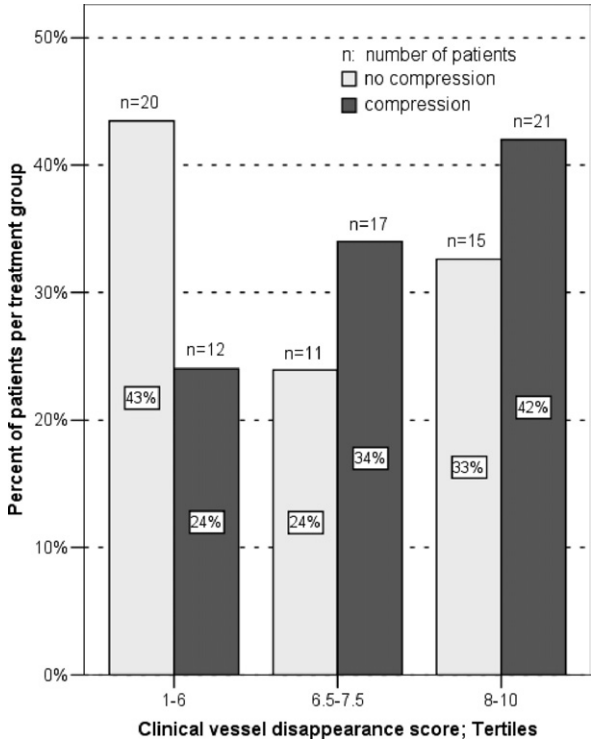

Fig 2. Vessel disappearance score: patients are divided into tertiles related to the vessel disappearance score. This analysis of three different vessel disappearance score demonstrates that all patients benefit from compression, enhances efficacy of sclerotherapy, and, also, avoids failures.

(vessel disappearance score over 6) but only 56.5% of the patients without compression reached this score value. This corresponds to an ARR of 21.5% and a RRR of 27.6% resulting into a NNT of 4.7. In other words, about five patients have to be treated with compression for one to obtain a vessel disappearance score higher than 6.

Patients rarely reported discomfort provoked by compression stockings, the median score being 10, the mean score 17.5 (+/-21.3) on a visual analogue scale of 0 to 100. As many as 38% of the patients experienced no discomfort (score 0). Only two patients had a discomfort score of more than 50.

The rate of complications was positively correlated with the discomfort of wearing stockings ($r = 0.29$, $P < .05$). In other words, patients who claimed a high discomfort of wearing stockings presented more complications.

Although micro-thrombi, matting, and pigmentations could sometimes be difficult to see on photographs, there was no discordance between the number of side effects reported from the physician and the ones reported from the blinded experts. Micro-thrombi were rarely observed in either group (15.2% in the no compression group, 10% in the compression group), but still less prevalent in the compression group (Table II). The rate of pigmentation and matting was low and did not differ significantly between the two groups.

Table II. Comparison of the side effects

	No compression	*Compression*
Micro-thrombi	7 (15.2%)	5 (10%)
Thrombus in reticular vein	0	1
Pigmentation	4	4
Matting	1	2

Micro-thrombi were rarely observed in either group, but still less prevalent in the compression group. The rate of pigmentation and matting was low and did not differ significantly between the two groups.

No serious side effects were encountered.

Quality of life. Ninety-three SF-36 questionnaires could be evaluated (45 WCG, 48 CG). The mean physical score was 54.1 prior to treatment and 54.4 at the control (52 days on the average) (ns). The mental score was 47.8 before treatment and 48.5 thereafter (ns). The physical score showed a statistical trend in favor of compression. The mean physical score is slightly over and the mean mental score slightly under the general populations norm (mean = 50 +/-10).

DISCUSSION

Although the utility of compression after sclerotherapy of telangiectasias is recommended in several countries, prospective studies demonstrating its efficacy are scarce, and include rather small numbers of patients. This prospective, randomized controlled study brings evidence that postsclerotherapy compression enhances vessel clearing after one single session of sclerotherapy of telangiectasias and their feeding reticular veins. We designed the study to evaluate the effect of compression stocking at the thigh, instead of at the calf were the pressure applied is higher. As the practitioner is often confronted with patient presenting telangiectasias at the thigh, the results of this study should help him in his treatment strategy. If compression enhances vessel disappearance at the thigh, it is probably also the case for the calf but the contrary could be not true.

As the compression pressure with 23 to 32 mm Hg compression stockings is low at the thigh and is much lower than the compression needed to empty telangiectasias from their blood,[10] it raises the question of mechanism of action. Hypothesis of action could be that compression does not act by reducing the lumen of the telangiectasias, but has an anti-inflammatory action in the peri-venous space. Compression stockings are classified according to the pressure exert at the ankle at rest. Their behavior when the patient is exercising may be different, including variation of pressure and the massage effect. Compression stockings could also reduce the blood flow from the feeding reticular veins and, therefore, enhance clinical disappearance of telangiectasias.

The absolute benefit of wearing stockings seems relatively small. However, departing from the patients' expectation that telangiectasias would clear totally or almost totally, an increase of vessel disappearance from 63% to 70% appears to be important. Furthermore, the number needed to treat is low: only five patients have to use compression for

one to enjoy its benefit. Poor outcome (vessel disappearance score under 6.5) was significantly more frequent in the no compression group (43% vs 24%). This means that compression not only enhances efficacy of sclerotherapy but also avoids failures.

Patient satisfaction showed a trend in favor of compression. In keeping, a significant correlation between the patient satisfaction score and the mean expert score was observed. As one can expect, it is difficult to compare such data because of the different nature of evaluation tools. Despite the fact that the patients rely in part on their visual memory and personal appreciation of the problem, and that the experts rely on objective images for the assessment of the results, a similar trend was noticed.

Side effects were scarce in both groups with a trend toward less micro-thrombi in the compression group (10% vs 15.2% in the WCG). The low incidence of side effects may be attributed to the sclerosing agent (chromated glycerin), which has been shown in our earlier study comparing different agents, to have a low complication rate.[5] In other studies assessing compression, polidocanol 0.25% to 0.75%, a mixture of dextrose and sodium chloride (Sclerodex), chromated glycerin (Scleremo) and sodium tetradecyl sulfate 0.15% to 0.25% were used, which showed higher rate of pigmentation in the no compression group (40%[4] and 100%,[7] respectively). In these studies, compression reduced the rate of pigmentation to 28.5%[4] and to 20%,[7] respectively.

There is a significant correlation between discomfort of wearing stockings and the rate of complication in our trial, which could suggest that these patients did not wear their stockings.

Quality of life assessment shows that patients seeking a treatment for telangiectasias have a normal physical and mental score. Therefore, in aesthetic telangiectasias cannot be considered as a disorder interfering with general quality of life. One session of treatment neither modified the mental nor the physical score. The degree of discomfort with wearing stockings was low and did not have a measurable negative impact.

CONCLUSION

In conclusion, 3 weeks of compression after sclerotherapy of telangiectasias and reticular veins improves the objectively assessed appearance after 52 days on the average, but does not influence the quality of life of the patients. There were too few adverse events for the effects of compression to analyze its impact in this study population.

The authors thank Werner Blättler (Zürich) for critical reading of the manuscript and Felix Amsler (Biel-Benken) for the statistical analysis of the data.

AUTHOR CONTRIBUTIONS

Conception and design: PK
Analysis and interpretation: PK, AR, DH, RW
Data collection: PK
Writing the article: PK
Critical revision of the article: AR, DH, RW
Final approval of the article: PK, AR, RW, DH
Statistical analysis: PK, DH
Obtained funding: Not applicable
Overall responsibility: PK

REFERENCES

1. Partsch H, Baccaglini U, Stemmer R. Questionnaire regarding the practice of sclerotherapy. Phlebology 1997;12:43-55.
2. Rabe E, Pannier-Fischer F, Gerlach H, Breu FX, Guggenbichler S, Zabel M; German Society of Phlebology. Guidelines for sclerotherapy of varicose veins (ICD 10: I83.0, I83.1, I83.2, and I83.9). Dermatol Surg 2004;30:687-93.
3. Neumann HAM, Kockaert MA. The treatment of telangiectasia. J Cosmet Dermatol 2004;2:73-81.
4. Goldman MP, Beaudoing D, Marley W, Lopez L, Butie A. Compression in the treatment of leg telangiectasia: a preliminary report. J Dermatol Surg Oncol 1990;16:322-5.
5. Kern P, Ramelet AA, Wutschert R, Bounameaux H, Hayoz D. Single-blind, randomized study comparing chromated glycerin, polidocanol solution, and polidocanol foam for treatment of telangiectatic leg veins. Dermatol Surg 2004;30:367-72
6. Goldman MP. How to utilize compression after sclerotherapy. Dermatol Surg 2002;28:860-2.
7. Weiss RA, Sadick NS, Goldman MP, Weiss MA. Post-sclerotherapy compression: controlled comparative study of duration of compression and its effects on clinical outcome. Dermatol Surg 1999;25:105-8.
8. Scultetus AH, Villavicencio JL, Kao TC, Gillespie DL, Ketron GD, Iafrati MD, et al. Microthrombectomy reduces postsclerotherapy pigmentation: multicenter randomized trial. J Vasc Surg 2003;38:896-903.
9. McCoy S, Evans A, Spurrier N. Sclerotherapy for leg telangiectasia--a blinded comparative trial of polidocanol and hypertonic saline. Dermatol Surg 1999;25:381-5
10. Goldman MP, Bergan JJ. Sclerotherapy treatment of varicose and telangiectactic leg veins. 3rd ed. St. Louis: Mosby; 2001.
11. Lord RS, Hamilton D. Graduated compression stockings (20-30 mm Hg) do not compress leg veins in the standing position. ANZ J Surg 2004;74:581-5.
12. Ware J, Sherbourne C. The MOS 36-Item Short-Form Health Survey (SF-36). Medical Care 1992;30:473-83.

Submitted Dec 23, 2006; accepted Feb 8, 2007.