

COMPRESSION BULLETIN

Robert Stemmer Library on Compression Therapy

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- **Superimposed Elastic Stockings: Pressure Measurements**
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Robert Stemmer Library on Compression Therapy was created by Robert Stemmer. It is a complete collection of publications of scientific and medical journals. It consists of three parts:

- Handbook „Compression Therapy of the extremities“, edited by Robert Stemmer in 1999 continuous literature updates, which are regular amendments of the handbook.
- The Compression Bulletin reports about important new publications.
- The table of contents of the Robert Stemmer Library:
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The Library is regularly updated with new publications; a selection is presented in the Compression Bulletin.

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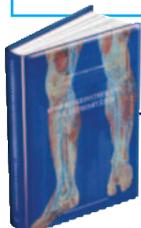
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**Special UIP edition:
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E. O. Brizzio, W. Blättler, G. Rossi, A. Chirinos, I. Cantero, G. Idiazabal, F. Amsler

Healing venous ulcers with different modalities of leg compression – Unexpected findings of a pilot study

BACKGROUND

Compression therapy (CT) is the stronghold of treatment of venous leg ulcers. We evaluated 5 modalities of CT in a prospective open pilot study using a unique trial design.

METHODS

A group of experienced phlebologists assigned 31 consecutive patients with 35 venous ulcers (present for 2 to 24 months with no prior CT) to 5 different modalities of leg compression, 7 ulcers to each group. The challenge was to match the modality of CT with the features of the ulcer in order to achieve as many healings as possible. Wound care used standard techniques and specifically tailored foam pads to increase local pressure. CT modalities were either stockings Sigvaris® 15–20, 20–30, 30–40 mmHg, multi-layer bandages, or CircAid® bandaging. Compression was maintained day and night in all groups and changed at weekly visits. Study endpoints were time to healing and the clinical parameters predicting the outcome.

RESULTS

The cumulative healing rates were 71%, 77%, and 83% after 3, 6, and 9 months, respectively. Univariate analysis of variables associated with non-healing were: previous surgery, presence of insufficient perforating and/or deep veins, older age, recurrence, amount of oedema, time of presence of CVI and the actual ulcer, and ulcer size ($p < 0.05$ – < 0.001). The initial ulcer size was the best predictor of the healing-time (Pearson $r = 0.55$, $p = 0.002$). The modality of CT played an important role also, as 19 of 21 ulcers (90%) healed with stockings but only 8 of 14 with bandages (57%); ($p = 0.021$). Regression analy-

sis allowed calculating a model to predict the healing time. It compensated for the fact that patients treated with low or moderate compression stockings were at lower risk of non-healing and revealed that healing with stockings was about twice as rapid as healing with bandages.

CONCLUSION

75% of venous ulcers can be brought to healing within 3 to 6 months. Healing time can be predicted using easy to assess clinical parameters. Irrespective of the initial presentation ulcer healing appeared more rapid with the application of stockings than with bandaging. These unexpected findings contradict the current concept and require confirmation in randomised trials.

COMMENT

Although this is not a randomized trial, these results show that ulcer healing can be sufficiently achieved by medical compression stockings. This confirms earlier findings by Partsch, Jünger and others^(1, 2). Healing rate with stockings was higher compared to bandages. These findings need to be confirmed in a prospective randomized trial.

Phlebologie 2006 35 5: 249–255

¹ Partsch H, Horakova MA. Compression stockings in treatment of lower leg venous ulcer. *Wiener Medizinische Wochenschrift*. 1994;144: 242–9

² Jünger M, Wollina U, Kohnen R, Rabe E. Efficacy and tolerability of an ulcer compression stocking for therapy of chronic venous ulcer compared with a below-knee compression bandage: results from a prospective, randomized, multicentre trial. *Current Medical Research & Opinion*. 2004; 20: 1613–23



Hirai M, Nukumizu Y, Kidokoro H, Hayakawa N, Iwata H, Nishikimi N, Sho K, Tsujisaka T, Komoatsubara R.

Effect of elastic compression stockings on oedema prevention in healthy controls evaluated by a three-dimensional measurement system.

BACKGROUND

Evening oedema of the legs is a physiological phenomenon seen in individuals after a working day. The degree of oedema formation may change between different sites of the legs.

METHODS

A three dimensional „grid pattern projection method“ using halogen light was used to measure the circumference and the volume of leg segments of 10 healthy limbs in the morning and in the evening on 5 consecutive days. On the first day the measurements were done without compression, on the following days stockings were applied in random order corresponding to the following pressure ranges: 8, 14, 22 and 30–40 mmHg.

RESULTS

A significant increase of circumference and volume in the evening without stocking was seen at the level of the foot and ankle, but not at the calf. With the stockings 8, 14 and 22 mmHg no increase was observed in the evening, the 30–40 mmHg stocking produced even a significant volume reduction. Probably because of measuring problems the coefficient of variation was greater in the foot compared to the other areas.

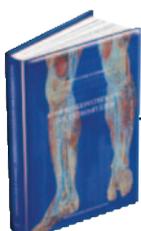
CONCLUSION

Evening oedema develops especially in the foot and ankle. Compression bandages with a pressure as low as 8 mmHg are able to prevent leg swelling.

COMMENT

The effect of light compression stockings preventing leg oedema should not only be considered for long distance travels but also during daily work in a sitting or standing position.

Skin Res Technol 2006; 12(1): 32–35.



Partsch H, Winiger J, Lun B.

Compression stockings reduce occupational leg swelling

BACKGROUND

Evening oedema of the legs is a physiologic phenomenon occurring after prolonged sitting and standing.

METHODS

Using water-displacement volumetry the volume of both lower legs from 12 volunteers working in a sitting or standing position was measured in the morning and 7 hours later. The difference of the evening-volume minus the morning volume was defined as evening oedema and expressed in ml. The procedure was carried out for 4 days, in which the subjects wore knee-high stockings of different compression levels alternatively on one leg in a random order. The pressure of the stockings was measured in vitro using the HATRA tester. The pressure levels of the four tested stockings were $5,9 \pm 2,4$ mmHg, $11,2 \pm 1,2$, $18,1 \pm 2,7$ and $21,8 \pm 1,8$ mmHg.

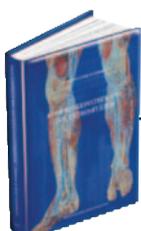
RESULTS

The left legs showed statistically significantly higher volumes than the right legs. (3358 ml versus 3292 ml, $p < 0.01$). The average evening oedema of the non-compressed legs was 62,4 ml on the left and 94,4 ml on the right side (n. s.). A significant reduction of evening swelling could be achieved with all stockings in pressure ranges of higher than 11 mmHg. After wearing $21,8 \pm 1,8$ mmHg-stockings the leg volume was smaller in the evening than in the morning in all cases except one. The highest degree of subjective comfort was reported for the 18 mmHg stockings.

CONCLUSION

Light calf-length compression stockings are able to reduce or totally prevent evening oedema and may therefore be recommended for people with a profession connected with long periods of sitting or standing.

Dermatol Surg 2004; 30: 737–43



Ogawa T, Hoshino S, Midorikawa H, Sato K.

Intermittent pneumatic compression of the foot and calf improves the outcome of catheter-directed thrombolysis using low-dose urokinase in patients with acute proximal venous thrombosis of the leg.

BACKGROUND

Conventional low-dose catheter-directed thrombolysis (CDT) is considered to be insufficient for thrombolysis of deep vein thrombosis, maybe due to the immobility of the patient.

AIM

To evaluate the efficiency and safety of Intermittent Pneumatic Compression (IPC) during CDT using low-dose urokinase.

METHODS

24 patients with proximal DVT were treated for 3 to 6 days, 10 by CDT alone, 14 by combining CDT with IPC and a temporary vena cava filter. 120.000 IU urokinase were followed by a 1-hour infusion of 120.000 IU twice daily for the next two days. The IPC was a two chamber system for the foot and calf using a pressure of 80 mmHg inflated in 6 seconds with intervals of 60 seconds. After CDT patients received unfractionated Heparin with overlapping warfarin and a 20 mmHg knee high compression stocking. Initial results were evaluated by venography immediately after CDT, the late results were assessed by venous disability score and Duplex sonography 6 to 36 months after therapy. Pulmonary emboli were assessed by pre-and post treatment pulmonary angiography or spiral CT.

RESULTS

Complete lysis was achieved in 5 cases from the IPC group versus 0 in the CDT group. In the follow-up deep veins were patent and competent in 6/14 (43%) in the IPC group, compared with 1/6 (17%) in the CDT group. The venous disability scores showed less disability in the IPC group. No symptomatic pulmonary embolism (PE) was seen in both groups. In the IPC group there was one case with new asymptomatic PE, but no large thrombi were detected in the caval vein and no large clots were seen trapped in the temporary filters when they were removed. The authors believe that a routine placement of caval filters may be unnecessary in future studies.

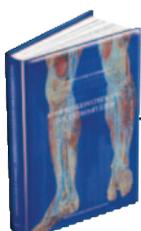
CONCLUSION

Adding IPC to CDT using low-dose urokinase results in a better early and late outcome compared with CDT alone and is not associated with a higher risk of symptomatic PE.

COMMENT

This pilot study underlines the importance of venous flow enhancement for better fibrinolysis. An interesting argument of the authors is the notation that by using IPC this improvement of venous flow is effective around the clock, while in patients encouraged to walk with compression this will be restricted to the phases of exercise only.

J Vasc Surg 2005; 42(5): 940-944.



Wienert V, Gerlach H, Gallenkemper G, Kahle B, Marshall M, Rabe E, Stenger D, Stücker M, Waldermann F, Zabel M

Guideline of the German Society of Phlebology: Medical Compression Stockings (MKS)

BACKGROUND

Treatment with medical compression stockings belongs to the basic concepts in venous diseases. The principles of this treatment are demonstrated in this guideline.

METHODS

All available randomized studies concerning MKS were evaluated by the experts of the guideline group prior to the consensus meeting. The results were classified in three levels of evidence: level A high evidence, level B medium evidence and level C weak evidence. The guideline was first discussed in the group and then passed by the board of the DGP and the professional organisation of phlebologists at the 4. October 2006.

RESULTS

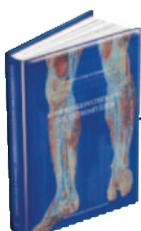
4 compression classes are defined: class I ankle pressure 18–21 mmHg, class II 23–32 mmHg, class III 34–46 mmHg and class IV more than 49 mmHg. Indications are: varicose veins, thromboembolic diseases, chronic venous insufficiency, oedema, scar treatment and burns. Absolute contraindications are severe arterial occlusive disease, decompensated cardiac insufficiency, septic phlebitis and phlegmasia coerulea dolens.

Based on the published randomized studies the following levels of evidence have been found. Prevention: level A for travel oedema, travel DVT and post-thrombotic syndrome. Level B for venous oedema, recurrence of venous ulcers and phlebitis after surgery. Therapy: level A for pain and oedema in deep venous thrombosis (DVT), symptoms of chronic venous diseases and venous ulcers. Grade B for venous symptoms in pregnancy, lipodermatosclerosis and lymphoedema of the extremities.

COMMENT

This actual guideline demonstrates the standardisation of compression stockings in Germany and the evidence based efficacy in different indications. For many indications prospective randomized studies exist but for other indications they are still missing.

Phlebologie 2006; 35: 315–320



Cornu-Thénard A, Boivin P, Carpentier P, Courtet F, Ngo P

Superimposed Elastic Stockings: Pressure Measurements

BACKGROUND

High-compression stockings over 40 mmHg are often difficult to apply. A specific technique is frequently used to overcome this problem: a high-compression stocking is replaced by two or even three lower compression stockings that are applied on top of each other, thereby reducing the effort of application. To our knowledge, however, no study concerning therapeutic stockings has demonstrated that the forces exerted by two or three superimposed stockings are additive. The objective was to evaluate if the pressure exerted by two or three superimposed elastic stockings are additive.

METHODS

A series of measurements was performed in vitro using an apparatus fitted with a pressure sensor on four different pre-made elastic stockings applied separately and then superimposed. The actual pressure measurement obtained with superimposed stockings was compared to arithmetic sum of the pressure produced by each of the stockings used.

RESULTS

The pressure produced by superimposed stockings are adequately predicted from the pressure given by each of the stockings used in the superposition, with correlation coefficients higher than 0.9.

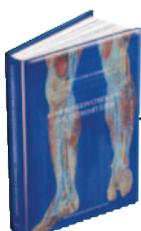
CONCLUSION

Under our experimental conditions, the superimposed elastic stocking pressure additivity hypothesis is confirmed. In vivo studies should be conducted to confirm those results.

COMMENT

These results show that the resting pressure below superimposed compression stockings is the sum of the individual pressures of each stocking. But resting pressure is not the only parameter responsible for the effectivity of compression garments. If different compression layers are superimposed also stiffness of the compound is changed. We know this from multilayer compression bandages in which the elasticity of the compound is different from the single components. These results demonstrate also that high compression can be achieved by superimposing compression stockings of lower compression classes.

Derm Surg 2007; 33: 269-275



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