SIGVARIS Compression Bulletin 04
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Published under the auspices of the IUP February 2003

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Compression Therapy of the Extremities

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Continuous literature update

Scientific articles on compression therapy worldwide are collected and quoted on Internet **www.sigvaris.com**

Compression Bulletin

A selection of some interesting articles is extracted and discussed in the Compression Bulletin (available by fax or e-mail)

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Identical chapter-titles in the continuous literature update and in the Compression Bulletin

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Jonker MJ, de Boer EM, Adèr HJ, Bezemer PD

The Oedema – Protective Effect of Lycra Support Stockings

Dermatology 2001;203:294-98

Aim of the study was to investigate the effect of mild compression stockings on the development of swelling of the legs and their effect on the subjective feeling in healthy individuals.

Methods

Using an optical leg volumeter the diurnal volume change (DVC) of the lower leg was measured in 118 healthy volunteers. DVC is defined by the difference in the recordings at the beginning and end of a full working day. Leg volume was measured from the ankle to a distance 30 cm above and the mean of 5 successive recordings was calculated.
Subjective complaints like tired/heavy feeling of the legs, swollen ankles and/or feet, restless legs and/or pain or cramps were assessed by a questionnaire. The comfort of the stockings was noted as well.

Two kinds of AD support stockings were compared: stocking X exerting a pressure of 14 mmHg at the ankle and stocking Y exerting a pressure of 18 mmHg. These stockings were applied in a randomly assigned order for at least 5 days each and the volume measurements were performed on 2 days. After wearing the support stockings, a control stocking (Z) exerting a pressure of 6 mmHg was worn for comparison.

Results

Females showed DVC values, which were significantly higher (2,3%) than in males (1,6%) (p=0,004). The mean reduction of DVC by the X- stocking (14 mmHg) compared to the Z-stocking (6 mmHg) was 31% in males and 18% in females (p=0,001). For the Y-stocking (18 mmHg) this effect was –37% in males and –32% in females (p=0,001).
At inclusion 47% complained about tired/heavy legs, 22% about swollen ankles/feet. Complaints were more common in women than in men and improved during the study period without significant differences between the stockings used. There was also no clear relationship between DVC and subjective feelings. 22% complained about a «too tight feeling», mostly in the upper part of the lower leg.

Conclusion

Mild compression stockings reduce diurnal oedema and unpleasant feelings of the legs after a working day in healthy individuals.

Comment

This study shows clear beneficial effects of light support stockings which do not fulfil the criteria of the European norm CEN, both on the «physiological evening-swelling» of the legs and on subjective symptoms like heavy feeling. Future studies

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are desirable in order to endorse these results. Such trials should consider the following points:
1. The method should be explained how the pressure of the stocking was measured. (Such methods are standardized for compression stockings fulfilling the criteria of the CEN norm but not for support stocking.
2. The precision and the reproducibility of the method should be given.
3. Results in millilitre and not only in % and % changes would be interesting.
4. Usually the measurement with the optical leg volumeter is performed in the horizontal position (-this is not mentioned in the text). Different results may be obtained using a water displacement volumeter in the upright position.

Experimental study
Chapter: 9
Lit.: 22/6
Lang.: ENG
Sum.: ENG

Partsch H, Menzinger G, Borst-Krafek B, Groiss E

Does thigh compression improve venous haemodynamics in chronic venous insufficiency?

J Vasc Surg 2002;36:948-52

Aim of this study was to investigate the hemodynamic effects of a thigh compression with different pressure-levels in patients with deep venous insufficiency.

Methods
12 patients with venous leg ulcer (C6 Es Ad Pr) (4 males, 8 females), mean age 56,5 ± 16,8 years, with refluxes in the popliteal vein > 1 second detected by Duplex were investigated by the following methods:
Subbandage pressure of thigh length compression stockings class II and of adhesive compression bandages was measured using an MST tester (Salzmann) and a CCS 1000 device (Juzo, Germany) respectively. The great saphenous vein and the femoral vein on the thigh were compressed by a pneumatic cuff (0, 20, 40, 60 mmHg) containg a window through which the diameters of these veins could be measured by Duplex. Using the same thigh-cuff occlusion procedure Venous filling index (VFI) was measured by Air plethysmography (APG) revealing quantitative values of venous refluxes depending on the degree of venous narrowing.

Results
1. The mean pressure of a class II compression stocking (Sigvaris 503) was about 15 mmHg on the thigh level while adhesive bandages achieved a mean pressure of more than 40 mmHg . 2. A statistically significant reduction of the diameter of the great saphenous vein and the femoral vein could be obtained only with a cuff pressure on the thigh equal or higher than 40 mmHg. 3. A reduction of venous reflux (VFI) was achieved only with a thigh pressure of 60 mmHg. There was no significant diminution of VFI by a thigh pressure in the range of class II stockings. 4. Previous investigations have shown that in patients with deep venous incompetence a pressure-cuff on the thigh with 60–80 mmHg is able to reduce ambulatory venous hypertension.

Conclusion
With a pressure of 40–60 mmHg on the thigh, which can be achieved by strongly applied bandages considerable narrowing of superficial and deep veins can be obtained. This leads to a reduction of venous refluxes even in patients with severe stages of deep venous insufficiency and to a reduction in ambulatory venous hypertension.

Comment
The observed improvement of venous hemodynamics by firm thigh compression may add to the favourable effects of good compression on the lower leg. On the other hand such an additional beneficial effect of thigh compression is questionable for class II compression stockings since the pressure of the thigh-part is too low. This finding is in accordance with the clinical experience that calf length stockings are sufficient for most patients with chronic venous insufficiency.

Experimental study
Chapter: 5
Lit.: 19/6
Lang.: ENG
Sum.: ENG

MacLellan DG

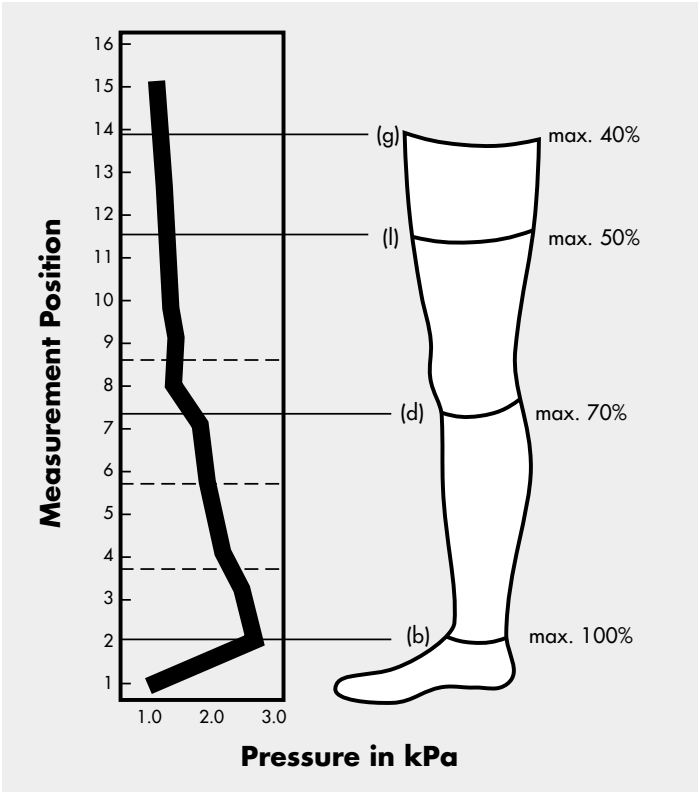
Compression Profiles of Antiembolic Stockings

Australian & New Zealand Journal of Phlebology 2002; 6: 9-14

Introduction
Venous thromboembolism (VTE) remains a major cause of morbidity and mortality in hospitalised patients.
In patients who are considered high risk for development of VTE combined pharmacological and mechanical methods of prophylaxis are recommended and are effective in reducing the risk of VTE. Both methods of VTE prophylaxis have some associated complications. E. g. antiembolic stockings roll down the leg, they may cause a tourniquet effect thus obviating any prophylactic benefit.
The aim of this study was to examine the levels and pressure profiles of 4 antiembolic stocking brands (small, medium and large sizes), available in Australia and used for VTE prophylaxis.

Material and Methods

The Hohenstein compression testing system was used to examine the compression levels and the pressure profile of each antiembolic stocking. This system is a dynamic system able to undertake separate and continuous pressure measurements in up to 20 test zones over the entire length of the stocking.
A typical pressure profile is shown in figure 1 beside a diagram of a leg with some of the measuring points and their ideal percentage pressures identified along its length.



Thigh length antiembolic stockings available from four manufacturers were examined. A minimum of 4 stockings for each of 3 sites was tested.
Stockings were separately examined when stretched to their minimal extent and to their maximal extent as detailed by the manufacturer on the stocking packs.

Results

One brand of stockings was unable to reproduce the recommended pressure gradient in any size, had low compression levels and commonly had reverse gradients. Two brands had some inconsistent pressure gradients particularly at maximum extension. Only one product had consistent pressure gradients and achieved the recommended compression levels at all measuring points.

Discussion

The effect of graduated compression on lower limb circulation has been the focus of considerable research. It is evident that wearing graduated compression stockings for VTE prophylaxis in appropriate patients reduces but does not eliminate the risk of VTE. The antiembolic compression stockings have to be correctly fitted to the individual and properly worn in a continuous manner during the period of immobility.
High length graduated compression stockings prescribed for VTE prophylaxis should ideally have compression levels of 18–20 mmHg at the ankle and provide a pressure profile of 100% at the ankle, 70% at the knee and 40% at the thigh. Importantly, each size of antiembolic stocking should be able to reproduce this profile whether they are extended minimally or maximally and this should be consistent in all brands. Standardisation of antiembolic stocking manufacture and testing would be a major benefit to ensure a quality of the products.
The results of the pressure profiles and compression levels of the tested antiembolic stockings in this study would suggest that some brands are at least potentially ineffective for VTE prophylaxis.

Comment

Antiembolic stockings should be made under strictly standardised rules concerning pressure profiles as is already the case in medical compression hoisery. Only correct fitting and pressure guarantees effectiveness in reducing the risk of VTE.

Experimental study
Chapter: 9
Lit: 15/0
Lang.: ENG
Abstr.: ENG

Aryal K, Dodds SR, Chukwulobelu R

Effect of Posture on the Pressure Exerted by Below-Knee Class II Compression Stockings on Normal Subjects

Phlebology 2002; 17:32-35

Introduction

Medical elastic compression stockings (MECS) are used in the management of patients with chronic venous insufficiency.
In Europe MECS are classified from class I to IV according to the static pressure exerted on the skin at the B level.

The pressure should decrease progressively to 50% of the ankle pressure at the knee (Tab. 1).

Compression class	Compression at the ankle (mmHg)
Class I (mild)	15–21
Class II (moderate)	23–32
Class III (strong)	34–46
Class IV (very strong)	≥ 49

The aims of this study were to test the hypothesis that correctly fitted class II stockings exert the expected graduated pressure profile over the region from the ankle to the knee and further to examine the effect of posture on this pressure profile.

Material and Methods

Seven healthy human volunteers (mean age 38 years) were fitted with CEN Class II below-knee compression stockings. Interface pressure measurements were made using an electropneumatic device of 3 cm diameter, flat air cell connected to a digital pressure gauge (Digitron Instruments) by a length of fine-bore, incompressible polyvinylchloride tube.
The sensor cell was placed under the fitted stocking on either the medial or lateral side of the leg and a series of interface pressure measurement were made at closely spaced intervals from the medial malleolus to the top of the stocking (32 cm) in each of the three postures: supine, sitting and standing.

Results

The interface pressure at 4 cm and 32 cm above the medial and lateral malleolus was not significant differrent from the recommended values in the different positions.
These results indicate that the class II stockings met the CEN criteria at the required reference levels in both the supine and standing postures. In the supine position however the pressure at the mid-calf (12 cm) was slightly greater than at the ankle ($p < 0,05$), creating a reverse pressure gradient which increased further on standing ($p < 0,05$) (Fig. 1).

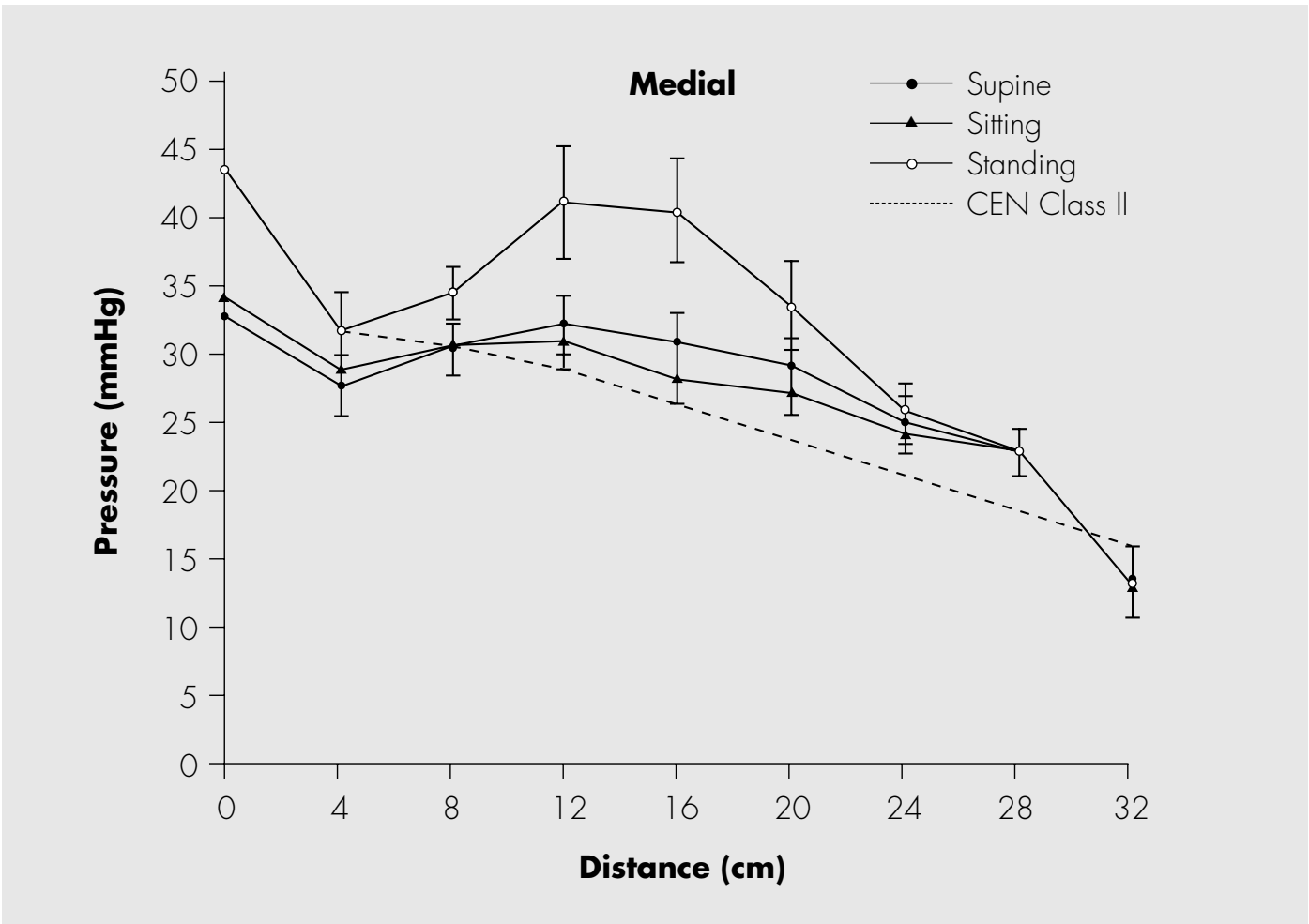
Conclusions

The in-vivo measured pressure profiles under correctly fitted class II stockings varies with posture due to the change in shape of the leg but fits in the CEN criteria at 4 and 32 cm. Only at mid-calf a reverse pressure-profile occured, increasing in the standing position. The resulting profile deviates from the theoretical ideal of a graduated pressure gradient that adapts with posture. The clinical significance of this effect is not known.

Comment

The interface pressure measured with a probe of 3 cm in diameter should always take into account that the results which are achieved are highly influenced by the local radius of the leg according to the law of Laplace. This fact is reflected by the higher pressure values measured over the malleolus at «distance 0». It is evident that this pressure will be extremely low behind the inner malleolus and will be still decreased in a zone proximal to this natural «fossa».
Therefore in vivo-pressure values being lower in the distal than in the proximal portion of the leg do not need to be taken as a sign of minor stocking quality.

Experimental study
Chapter: 9
Lit: 18/0
Lang.: ENG
Abstr.: ENG



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