

## Compression stockings with interface pressure fall and rise from the ankle to the mid calf

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### Introduction

The therapeutic effectiveness of compression therapy depends on the selection of compression hosiery.

### Objectives

To assess interface pressure, clinical efficacy and tolerability of graduated elastic compression stockings (GECS) and inverse graduated elastic compression stockings (PECS).

### Materials and Methods

Study design: prospective, mono-centric, open randomized, double blind, controlled and cross over trial with a test period for 3 weeks. 32 healthy volunteers and 32 patients with chronic venous insufficiency (CVI) were analyzed, wear period: 1 week for each stocking type (randomized, blinded). Primary outcome: venous drainage. Secondary outcomes: volume reduction of *lower leg* (Image3D®) and *distal leg and foot* (water plethysmography), clinical

symptoms of CVI assessed by the Venous Clinical Severity Score (VCSS), side effects and wear comfort in both groups.

### Results

Demographics: Gender distribution - 19 male: 45 female subjects [2 cohorts with 32 healthy volunteers and 32 patients with CVI (CEAP 3 = 27, CEAP 4 = 5)]. Interface pressure: median pressure with GECS at B1 was 27 mmHg and at C 19.5 mmHg; median pressure with PECS at B1 was 18 mmHg and at C 25 mmHg. Volume of *lower leg*: significant reduction with both stockings (median GECS: -50 mL; median PECS: -30 mL). Volume of *distal leg and foot*: significant reduction with both stockings (median GECS: -30 mL; median PECS: -24 mL). Between the volume reductions achieved by GECS and PECS there was no significant difference. Wear comfort of the two stockings (0 = not present, 1 = low present, 2 = moderate present, 3 = highly present): GECS showed less strangling (GECS: 1.19 *versus* PECS: 0.80;  $P < 0.05$ ) and tightness of the leg (GECS: 1.06 *versus* PECS: 0.48;  $P < 0.001$ ) occurred fewer. Donning of PECS was significantly easier (GECS: 1.63, PECS: 0.58;  $P < 0.001$ ), but they also slipped down more often (GECS: 0.34 *versus* PECS: 1.47;  $P < 0.001$ ). Venous pumping function: GECS showed to be more effective to improve venous ejection fraction (mean delta EF with GECS: 53.11%; mean delta EF with PECS: 35.99,  $P = 0.2$ ). Venous reflux: VFI was lower in healthy volunteers (0.04 %/s) than in patients (0.24 %/s) without compression. No significant

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Veins and Lymphatics 2017; 6:6632  
doi:10.4081/vl.2017.6632

difference  $P > 0.05$  in lowering VFI when applying GECS (mean delta VFI: -0.138) and PECS (mean delta VFI -0.144). VCSS: Both compression stockings improved venous symptoms significantly over one week ( $P < 0.001$ ). Significantly better mean reduction of the VCSS with GECS (-1.0) than with PECS (-0.3).

### Conclusions

Conventional compression with graduated elastic compression showed to be very effective in this study and remain an important element in the compression therapy. Inverse graduated elastic compression showed to reduce subject's leg volume and also improved the haemodynamic of the leg as well as clinical symptoms in the VCSS. When the low compliance is often a limiting factor in compression therapy, the concept of PECS with its advantages in wearing comfort, could be promising. More randomized controlled trials are needed.