the effectiveness of comfort

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retired 3M employee
inventor & co-developer of the
3M™ Coban™ 2 Layer
compression systems

conflict of interest

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the effectiveness of comfort

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the effectiveness of **comfort**

- assistance; relief; support
- a state of quiet enjoyment; freedom from pain, want, or anxiety; also, whatever contributes to such a condition

the effectiveness of comfort

- the quality of being able to bring about an effect
- capacity to produce strong physiological or chemical effects

from:
the Merriam-Webster Collegiate Dictionary.
the effectiveness of comfort from:

Partsch H.  
Compression therapy: clinical and experimental evidence.  
Ann Vasc Dis 2012; 5: 416-422.
... compression therapy

definition of comfort

from:

mode of action:
... compression acts most effectively when it is combined with movement

... during walking, non-yielding stiff material will exert a massaging effect to the leg resulting in a reduction of ambulatory venous hypertension

citation:
Compression is more effective in healing chronic venous ulcers compared with no compression.

Multi-layered systems are more effective than single-layered systems.

High compression is more effective than low compression but there are no clear differences in the effectiveness of different types of high compression.

Compression is more effective in healing chronic venous ulcers compared with no compression.

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The effectiveness of comfort.

From:
Compression is more effective in healing chronic venous ulcers compared with no compression.

Multi-layered systems are more effective than single-layered systems.

High compression is more effective than low compression but there are no clear differences in the effectiveness of different types of high compression.

High compression is not comfortable.

The effectiveness of comfort.
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3M™ Coban™ 2 Layer
3M™ Coban™ 2 Lite
the effectiveness of comfort

different resting pressure

similar SSI's and amplitudes
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the effectiveness of compression can be demonstrated by measuring the improvement of the ejection fraction (EF)

strain-gauge plethysmography

sub bandage pressure recording

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modified from:
Schuren J.
Compression unravelled.
Margreff Druck GmbH, Essen Germany 2011.
significant difference in resting pressure
but no significant differences
in static stiffness index or amplitudes
(19 patients, 20 legs)

resting pressure (mmHg)
static stiffness index
amplitudes

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modified from:
Schuren J.
Compression unravelled.
Margreff Druck GmbH, Essen Germany 2011.
both systems significantly improve the ejection fraction but reveal no significant differences

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Compression in this study resulted in ejection fraction values that are close to the values found in healthy volunteers.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Coban 2 Layer</th>
<th>Coban 2 Lite</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Legs</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Patient Legs</td>
<td></td>
<td></td>
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<tr>
<td>Legs in study</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>VV (mL%)</td>
<td>4.4 (3.9-5.1)</td>
<td>5.1 (4.2-6.3)</td>
<td>6.13 (2.9-9.6)</td>
<td></td>
</tr>
<tr>
<td>EV (mL%)</td>
<td>3.0 (2.5-3.4)</td>
<td>1.6 (1.3-2.1)</td>
<td>2.2 (0.8-3.8)</td>
<td></td>
</tr>
<tr>
<td>EF%</td>
<td>65.0 (63.7-67.8)</td>
<td>33.1 (27.0-38.3)</td>
<td>36.5 (26.3-39.3)</td>
<td></td>
</tr>
</tbody>
</table>

The effectiveness of comfort.

Modified from:
volumetry measurements (0, 24 & 48 hours) with both systems on both legs of
12 healthy volunteers (perfect match)

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modified from:
Damstra RJ, Brouwer ER, Partsch H.
Controlled, comparative study of relation between volume changes and interface pressure under
significant difference in resting pressure but no significant differences in static stiffness index or amplitudes

pressure profile immediately after application 1

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modified from:
Schuren J.
Compression unravelled.
Margreff Druck GmbH, Essen Germany 2011.
no significant difference in % volume reduction

the effectiveness of comfort

modified from:
Schuren J.
Compression unravelled.
Margreff Druck GmbH, Essen Germany 2011.
an average volume reduction of > 4% (3.14-7.63) in 48 hours in healthy volunteers!!

The effectiveness of comfort

modified from:
Schuren J.
Compression unravelled.
Margreff Druck GmbH, Essen Germany 2011.
modified from: Hirai M, Partsch H.


relation between pressure & stiffness

the "mannequin leg"

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relation between pressure & stiffness by pushing down the lever, the circumference of the model will increase by 1 cm at each level

the "mannequin leg"

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modified from: Hirai M, Partsch H.

The effectiveness of comfort

relation between pressure & stiffness

stiffness

0 10 20 30 40 50

pressure (mmHg)

0 10 20 30 40 50 60

stocking + elastic bandage

stockings

double stockings

modified from:
Hirai M, Partsch H.
The Mannequin-leg, a new instrument to assess stiffness of compression materials.
Veins and lymphatics 2013; 2-e3: 7-10.
relation between pressure & stiffness

stiffness

Coban 2 Lite

Rosidal Sys

Actico

Profore

stocking + elastic bandage

double stockings

stockings

pressure (mmHg)

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modified from:
15 patients with PAOD

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15 patients with PAOD
≡ ABPI between 0.5 - 0.8
≡ 2 weeks voluntary Coban 2 Lite compression
≡ mean pressure after application < 30 mmHg

Modified from:
Jünger M, Haase H, Schwenke L, Bichel J, Schuren J, Ladwig A.
Macro- and microperfusion during application of a new compression system,
designed for patients with leg ulcer and concomitant peripheral arterial occlusive disease.
15 patients with PAOD

- pressure measurements (B1), acral pulsation (hallux),
- laser Doppler fluxmetry (forefoot) and volumetry

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Jünger M, Haase H, Schwenke L, Bichel J, Schuren J, Ladwig A.
Macro- and microperfusion during application of a new compression system,
designed for patients with leg ulcer and concomitant peripheral arterial occlusive disease.
15 patients with PAOD

laser Doppler fluxmetry indicated significant improvements of the microcirculation \((p=0.01)\)

modified from:

15 patients with PAOD in addition:

- reduction of swelling (avg. 7.3% (SD 7.9%: p=0.03)
- no pain or skin problems
- comfortable compression - good tolerance

modified from:

25 patients with PAOD
(mean ABPI: 0.58; range: 0.5-0.65)

Compression therapy in mixed ulcers increases venous output and arterial perfusion

Giovanni Mosti, MD, Maria Letizia Iabichella, MD, and Hugo Partsch, MD, Lucca, Italy; and Vienna, Austria

Objectives: This study was conducted to define bandage pressures that are safe and effective in treating leg ulcers of mixed arterial-venous etiology.

Methods: In 25 patients with mixed-etiology leg ulcers who received inelastic bandages applied with pressures from 20 to 30, 31 to 40, and 41 to 50 mm Hg, the following measurements were performed before and after bandage application to ensure patient safety throughout the investigation: laser Doppler fluxmetry (LDF) close to the ulcer under the bandage and at the great toe, transcutaneous oxygen pressure (TcPO2) on the dorsum of the foot, and toe pressure ejection fraction (EF) of the venous pump was performed to assess efficacy on venous hemodynamics.

Results: LDF values under the bandages increased by 33% (95% confidence interval [CI], 17-48; P < .01), 28% (95% CI, 12-45; P < .05), and 10% (95% CI, -7 to 28), respectively, under the three pressure ranges applied. At toe level, a significant decrease in flux of -20% (95% CI, -48 to 9; P < .05) was seen when bandage pressure >41 mm Hg. Toe pressure values and TcPO2 showed a moderate increase, excluding a restriction to arterial perfusion induced by the bandages. Inelastic bandages were highly efficient in improving venous pumping function, increasing the reduced ejection fraction by 72% (95% CI, 50%-95%; P < .001) under pressure of 21 to 30 mm Hg and by 103% (95% CI, 70%-128%; P < .001) at 31 to 40 mm Hg.

Conclusions: In patients with mixed ulceration, an ankle-brachial pressure index >0.5 and an absolute ankle pressure of >60 mm Hg, inelastic compression of up to 40 mm Hg does not impede arterial perfusion but may lead to a normalization of the highly reduced venous pumping function. Such bandages are therefore recommended in combination with walking exercises as the basic conservative management for patients with mixed leg ulcers. (J Vasc Surg 2012; 55:122-8.)
25 patients with PAOD
inelastic compression of up to 40 mmHg (B1):

- increases the arterial perfusion of the compressed part of the leg
- does not detoriate the arterial perfusion distal to the bandage
- significantly increases transcutaneous oxygen pressure on the forefoot
- significantly improves the reduced venous pump function (EF)

laser Doppler flux sub-bandage (peri-wound skin)

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**baseline** 20-30 mmHg 31-40 mmHg

perfusion units

- 3% (n.s.)
- 4% (n.s.)
- 20% (p<0.05)

laser Doppler flux distal to the bandage (toe)

modified from:
Mosti G, Iabichella L, Partsch H.
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TcPo$_2$ measurements (Periflux system 5000)

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Ejection fraction (strain-gauge plethysmography)

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Ejection fraction (strain-gauge plethysmography)

Ejection fraction

baseline  20-30 mmHg  31-40 mmHg

- Normal range

- Ejection fraction:
  - Baseline
  - 20-30 mmHg: +72% (p < 0.01)
  - 31-40 mmHg: +103% (p < 0.001)

modified from:
Mosti G, Iabichella L, Partsch H.
Compression therapy in mixed ulcers increases venous output and arterial perfusion
conclusion

- increasing comfort by decreasing pressure does not automatically lead to
- reduced effectiveness

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thank you for your attention