Demystifying Compression

Terry Treadwell, MD, FACS
Medical Director
Institute for Advanced Wound Care
Montgomery, Alabama

Compression Questions

1. Are all compression bandages the same?
2. Can compression therapy be used in the patient with edema and an ABI < 0.87?
3. Can compression therapy be used in the patient with edema and cellulitis?
4. Does compression therapy improve the skin of patients with venous dermatitis?
5. Can compression therapy be used in the patient with edema and congestive heart failure?
6. Can compression therapy be used in the patient with edema and acute deep venous thrombophlebitis?
7. Do patients care which compression bandage is used?

Looking for the Evidence??
Are all compression bandages the same?

Compression Therapy

- Short stretch or inelastic
- Elastic
- Single layer
- Multiple layers
- High pressure
- Low pressure

Compartments
Pressures of Interest

- Tibialis m.
- Popliteus m.

Sub-bandage • Surface • Contact

Compression Bandage or Device

• Tissue • Interstitial
• Intramuscular

Resting Pressure

Pressure (P) Due to Tension (T) of Bandage and the Radius (R) of the Leg

LaPlace’s Law

\[ P \sim \frac{T}{R} \]

Superficial vessels affected the most

Working (Dynamic) Pressure

Muscles Contract

Bandage Restricts Muscle Contraction

High Pressure Develops on Deeper Tissues

Pressure Is From WITHIN
Dynamic Pressure Depends on Bandage Material Features

- Form-fitted Steel Pipe (Cast)
- Inelastic (short stretch)
- Elastic (long stretch)
- No External Compression

Working vs. Resting Pressures
Role of Compression Material

- Filling
- Short Stretch
- Long Stretch

Pascal’s Law

Equal Distribution of Pressure Throughout the Leg with Muscle Contraction
**Short Stretch Vs. Multi-stretch**

- Short stretch systems are effective at a lower resting pressure than multi-stretch systems.
- A lower resting pressure offers safer compression in the compromised limb.
- Both systems can produce effective, dynamic working and resting pressures.

**Can compression therapy be used in the patient with edema and an ABI < 0.8?**

**Venous Ulcers and PVD**

1416 leg ulcers with venous reflux

- 84% have ABPI >1
- 0,85-0,5: 14%
- <0,5: 2%

Humphreys ML et al. Br J Surg 2007 Sep;94(9):1104-7
Venous Ulcer Healing

Arterial Flow Pulses
Below Knee Blood Flow via Nuclear Magnetic Resonance

Control Leg | Treated Leg
---|---
Before Bandage | With Bandage

Compression Therapy and Circulation

<table>
<thead>
<tr>
<th>ABI</th>
<th>Bandage</th>
<th>Sub-bandage pressure (mm Hg)</th>
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</thead>
<tbody>
<tr>
<td>≥ 0.8</td>
<td>4-layer</td>
<td>35-40</td>
</tr>
<tr>
<td>0.7</td>
<td>2-layer</td>
<td>17-25</td>
</tr>
<tr>
<td>0.6</td>
<td>2-layer</td>
<td>17-25</td>
</tr>
<tr>
<td>&lt;0.5</td>
<td>Only with medical supervision</td>
<td>---</td>
</tr>
</tbody>
</table>

Moffatt C. www.worldwidewounds.com (12/5/09)
Compression and Arterial Insufficiency

- 15 patients suffering from peripheral arterial occlusive disease with an ankle brachial pressure index (ABPI) of 0.5-0.8
  1) 5 patients with ABPI of ≥0.5 and ≤0.6
  2) 4 patients with ABPI of >0.6 and ≤0.7
  3) 6 patients with ABPI of >0.7 and ≤0.8
- All patients treated with 3M™ Coban™ 2 Layer Lite Compression System
- Bandage remained on the leg 1 to 4 days
- Study stopped after 14 days

Results of 3M™ Coban™ 2 Layer Lite Compression System Study

- An average supine subbandage pressure of ~28mmHg was measured just above the medial ankle after bandage application
- No pressure-related skin damage occurred in patients with reduced arterial perfusion
- No pain related to tissue hypoxia was detected

Results of 3M™ Coban™ 2 Layer Lite Compression System Study

- Laser doppler fluxmetry demonstrated positive effects on microcirculation including:
  - Increased overall tissue microperfusion
  - Reduced respiratory reflux in limbs with venous insufficiency
  - Maintained stable capillary perfusion
- Limb volume reduction (reduced edema) compared to baseline
- High wearing comfort

Data on file – 3M
Conclusions:
3M™ Coban™ 2 Layer Lite Compression System Study

- Compression with Coban 2 Layer Lite Compression System is safe and well tolerated by patients with reduced peripheral arterial perfusion
- Results of the laser doppler fluxmetry measurements indicate significant improvements of the dermal microcirculation under this compression therapy

Data on file – 3M

UNDER the Bandage: Increase of Flow

DISTAL to the Bandage

No impairment of arterial flow up to a pressure of 40 mmHg
Inelastic Compression Improves Venous Pump

Venous Ulcer
99 year old lady with ulcer for 8 months
ABI - 0.45
Informed that BK amputation was the only therapy
Treated with light compression and bi-layered tissue engineered skin
Wound healed after 47 weeks

Compression Bandage Too Tight Over Bony Prominences
Warning!!!

Sustained bandage pressure should never exceed the arterial perfusion pressure (= ankle pressure)!

Persisting or increasing pain:
Remove the bandage!

Can compression therapy be used in the patient with edema and cellulitis?


Edema and Compression Therapy in Cellulitis

1. Normal anti-Streptococcal properties of skin are inactivated by edema fluid
2. Compression therapy:
   • Removes protein-containing fluid from the subcutaneous tissues
   • Increases blood flow to tissues
   • Increases antibiotic concentration in tissues
Cellulitis of Leg

Healed after
10 days of antibiotics and 5 weeks of compression therapy

Does compression therapy improve the skin of patients with venous dermatitis?

Properties of Edema Fluid

1. Edema fluid inhibits mitogenic activity and DNA synthesis.
2. Cytokine environment in edema fluid is more proinflammatory.
3. Protease activity is higher in edema fluid.
4. Growth factors levels are decreased in edema fluid.

### Fibroblast Senescence and Venous Ulcers

<table>
<thead>
<tr>
<th>Patient</th>
<th>Normal (%)</th>
<th>Wound (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM</td>
<td>1</td>
<td>14.9</td>
</tr>
<tr>
<td>BB</td>
<td>1</td>
<td>12.6</td>
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<tr>
<td>SK</td>
<td>0.33</td>
<td>4.0</td>
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<tr>
<td>AS</td>
<td>0.66</td>
<td>17.6</td>
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<tr>
<td>OB</td>
<td>1.33</td>
<td>14.3</td>
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<tr>
<td>RG</td>
<td>0.33</td>
<td>21</td>
</tr>
<tr>
<td>FF</td>
<td>2.33</td>
<td>26.3</td>
</tr>
</tbody>
</table>


### Fibroblasts and Chronic Wound Fluid

*P* = .006; †*P* < .03.
CM = complete media; VUWF = venous ulcer wound fluid; SA-β-gal = senescence-associated β-galactosidase

### Proteases and Compression Therapy

Can compression therapy be used in the patient with edema and congestive heart failure?

Massive Edema and CHF

Photo used with permission

Congestive Heart Failure and Compression Therapy

- No acute pulmonary edema
- Once treatment started with cardiotimulatory medications and diuretics

Can compression therapy be used in the patient with edema and acute deep venous thrombophlebitis?

Compression Therapy and Acute Deep Venous Thrombophlebitis

- Increases venous flow
- Prevents further clotting
- Occludes superficial veins that could clot
- Does not cause an increase in pulmonary embolism


Contraindication to Compression in Acute Deep Venous Thrombophlebitis

Leg so painful that compression cannot be tolerated.

Do patients care which compression bandage is used?

Fact: Patients don’t like compression bandages!
- Only 48.8% of patients wore their compression bandages *
- May be as high as 80% *
- Determinants for NOT wearing compression bandages:
  a. Age
  b. Pain
  c. Wound size
  d. Wound depth


Is this comfortable?
Patient Preference for Compression Therapy

- 72% of patients preferred Coban 2 Layer Compression System over Profore when treated with both for venous ulcer
- Coban 2 Layer Compression System showed less slippage than Profore
- Quality of Life assessments were better with Coban 2 Layer Compression System than with Profore (p<0.05)


Compression Questions

1. Are all compression bandages the same? NO
2. Can compression therapy be used in the patient with edema and an ABI < 0.8? YES
3. Can compression therapy be used in the patient with edema and cellulitis? YES
4. Does compression therapy improve the skin of patients with venous dermatitis? YES
5. Can compression therapy be used in the patient with edema and congestive heart failure? YES
6. Can compression therapy be used in the patient with edema and acute deep venous thrombophlebitis? YES
7. Do patients care which compression bandage is used? YES
"It is the individual patient who we treat, not the disease. It is the patient who recovers or dies, not the illness."

Sponsored by an educational grant from 3M

For more information on 3M Compression Therapy visit www.3m.com/coban2layer

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