Good bye slippage
– a new fusion to tackle bandage slippage on the foot

Presenters:
Josefin Damm & Andreas Nilsson
Disclaimer/Conflict of Interest

• Josefin Damm: Co-inventor of Lundatex® products, co-founder of PressCise
• Andreas Nilsson: CEO of PressCise

• None of the presenters are nurse or MD
“In fact, the medical field of compression treatment is maybe the only one where quantitative dosage has almost never been measured, despite outcomes largely depending on it.”

Mosti & Partsch,
Eur J Vasc Endovasc Surg (2017)
Problem with bandage application – no consistency in pressure

Protz et al. 2014

- 551 healthcare personnel
- Target pressure: 50-60 mmHg
Our solution – to control the pressure

Precise pressure over the entire leg:
• Invariant of different appliers
• Different sizes
• Different shapes
(Oedema – swelling/deswelling)

Lundatex® medical
Study by Wiklander et.al. (2015)

Original Article

An investigation of the ability to produce a defined ‘target pressure’ using the PressCise compression bandage

Kerstin Wiklander¹, Annette Erichsen Andersson² & Ulrika Källman³,⁴
Study by G. Mosti & H. Partsch (2017)

• 25 legs from 25 patients
• Venus insufficiency

“…all affected by clinically significant reflux in the great saphenous vein (GSV), with clinical stage C2-C5”
Study by G. Mosti & H. Partsch (2017)

A New Two Component Compression System Turning an Elastic Bandage into an Inelastic Compression Device: Interface Pressure, Stiffness, and Haemodynamic Effectiveness

Giovanni Mosti 1,*, Hugo Partsch 2
1Department of Angiology, Medico-dentistic Clinic, Lucca, Italy
2Department of Medical University of Vienna, Vienna, Austria

Interface pressure

B1-point: Medial side gastrocnemius muscle turns into the tendinous part

C-point: at maximum calf circumference

<table>
<thead>
<tr>
<th></th>
<th>supine</th>
<th>standing</th>
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<tbody>
<tr>
<td>Minimum</td>
<td>16.00</td>
<td>17.00</td>
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<tr>
<td>Median</td>
<td>20.00</td>
<td>21.00</td>
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<tr>
<td>Maximum</td>
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<tr>
<td>Mean</td>
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<tr>
<td>Std. Deviation</td>
<td>2.179</td>
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<td>25.00</td>
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<tr>
<td>Maximum</td>
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<tr>
<td>Mean</td>
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<td>24.80</td>
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<tr>
<td>Std. Deviation</td>
<td>2.670</td>
<td>4.320</td>
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Uniform & constant pressure
How does it work?
- Lundatex medical is based on Laplace’s law

Pressure = \textbf{force} \times \text{overlap} \times \text{curvature}
Pressure = force $\times$ overlap $\times$ curvature

How does it work?
- Lundatex medical is based on Laplace’s law
Pressure = force × overlap × curvature
Bandages with markings – same same but different?

Pressure = \textcolor{red}{\text{force}} \times \text{overlap} \times \text{curvature}
Why we need innovation in stockings

- Fitting / Custom made stockings
  - Pressure?

- Oedema – swelling/deswelling
  - Pressure?

- Comfort
  - patient compliance

- Donning problems
  - varies with compression class and elasticity of the material used
A new Smart Textile Stocking

New properties allows for:

- Well-defined pressure (20 mmHg)
- Uniform pressure
- Ensured pressure regardless of leg shape
- Easier donning
Two limited pilot studies – methods

1. 1st study: 10 healthy subjects (5 women and 3 men)
2. 2nd study: 8 healthy subjects (5 women and 5 men)

Interface pressure was measured with a Picopress
At B1-level gastrocnemius muscle turns into the tendinous part:
B1 – medial
B2 – lateral

At C level - point at maximum leg-circumference:
C1 – medial
C2 – posterior
C3 – lateral
Results – 1st pilot study

- Leg circumference
- Range 20.7 – 29.3 cm
- Range 30.3 – 51.0 cm

<table>
<thead>
<tr>
<th>Sensor Position</th>
<th>Interface pressure Mean (mmHg)</th>
<th>SD</th>
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<tbody>
<tr>
<td>B1</td>
<td>20.7</td>
<td>1.6</td>
</tr>
<tr>
<td>B2</td>
<td>21.1</td>
<td>1.7</td>
</tr>
<tr>
<td>C1</td>
<td>20.9</td>
<td>1.7</td>
</tr>
<tr>
<td>C2</td>
<td>21.9</td>
<td>1.7</td>
</tr>
<tr>
<td>C3</td>
<td>21.8</td>
<td>2.2</td>
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</table>
Results – 2\textsuperscript{nd} pilot study

Same stocking used on all 8 subjects!

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{Graph showing interface pressure vs. leg circumference with R\textsuperscript{2} = 0.0387.}
\end{figure}
Uniform & constant pressure

20 mmHg

20 mmHg

20 mmHg

20 mmHg

20 mmHg

20 mmHg
Problem with bandage application on the foot

“Bandage slippage can create local high-pressure areas that may cause tissue damage and even necrosis.”

What if we take the best from two worlds and combine into one solution?

Potential dangerous zone!
- Too low pressure
- Too high pressure

20mmHg
Pressure?
20mmHg

andreas@presscise.com
ejosefin@presscise.com
Pilot study, method – sock-bandage fusion

- Thirteen healthy subjects (six females, seven males)
- Three pressure sensors were placed unilaterally: (A) on the foot, (B) at the ankle and (C) on the calf
Pilot study, method – sock-bandage fusion

1. Sock (20 mmHg) covering sensor A
2. 5 cm cuff of the sock (10 mmHg) covering sensor B
3. 5 cm first bandage turn (10 mmHg) covering sensor B
4. Bandage (20 mmHg) covering sensor C
5. The interface pressure was measured with a Picopress® in supine and standing

andreas@presscise.com
josefin@presscise.com
Results – sock-bandage fusion

Same sock used on all 13 subjects!

<table>
<thead>
<tr>
<th></th>
<th>Foot (A)</th>
<th>Ankle (B)</th>
<th>Leg (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Supine</td>
<td>20</td>
<td>2.9</td>
<td>20</td>
</tr>
<tr>
<td>Standing</td>
<td>20</td>
<td>3.9</td>
<td>21</td>
</tr>
</tbody>
</table>

The sock-bandage fusion method applied a well-defined pressure at the foot, ankle and leg.
Results – sock-bandage fusion

Supine

R = 0.17

Standing

R = 0.29

Sensor position

Leg C

Ankle B

Foot A

Interface pressure (mm Hg)

Circumference (cm)
Conclusion – sock-bandage fusion

• Well defined pressure – on foot, ankle and leg
• Easy donning – on the foot and leg
• Comfortable – even pressure, no slippage
• Preserves normal ankle range-of-motion
• Ability to wear normal footwear – no bulky material
Good bye slippage!

Thank You!

josefin@presscise.com  andreas@presscise.com