Standardization of a pressure-measuring device for optimizing lymphedema treatment with compression garments

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Background

- Breast cancer is the most common cancer in women
- Treatment of breast cancer often results in axillary clearance and radiotherapy with lymphedema as a complication
- Lymphedema is initially treated with compression stockings
- Compression is empirically well-proven
- Few studies measure the actual pressure under the garment
Background

- The measurement method could provide more customized treatment
- Better prerequisite for future research
Aim

- Create measurement method using I-scan® (Tekscan Inc.) pressure measurement equipment
- Measure the initial pressure as 5 compression garments from 3 manufacturers
- Measure the pressure that the garment exerts after simulated wear and tear
Method and Material
Compression Garments

- 5 compression garments from 3 companies A, B, C
- Compression class 3: 34.0 - 46.0 mmHg
Pressure Measurement Device

- I-scan® (Tekscan Inc.)
- Ultra-thin sensor
Pressure Measurement Device

- Transducer
- PC
Pressure Measurement Device

- Calibration of the sensor
Plastic Legs

- 15 legs, HD polyethylene
- Tonometry test of 3 different surface materials: (1) bare legs, (2) legs lined with standard Velcro (Polyamide), (3) legs lined with Poron urethane foam
- Poron urethane foam is close to human tissue
Measurements
Simulated wear and tear

- Initial measurements
- Thereafter weekly program: garments washed every evening to dry during night, put on plastic legs daytime during 7 days
- After 7 days subgarment pressure is registered
- This is repeated during 4 weeks
Results

Visual difference in the profile of garments
# Initial Measurements

<table>
<thead>
<tr>
<th>mmHg</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>29,7</td>
<td>36,3</td>
<td>35,2</td>
</tr>
<tr>
<td>Median</td>
<td>27,4</td>
<td>34,8</td>
<td>31,2</td>
</tr>
<tr>
<td>Max</td>
<td>44,5</td>
<td>54,7</td>
<td>55</td>
</tr>
<tr>
<td>Min</td>
<td>20,8</td>
<td>25,1</td>
<td>24,9</td>
</tr>
<tr>
<td>SD</td>
<td>7,1</td>
<td>8,1</td>
<td>8,6</td>
</tr>
<tr>
<td>SEM</td>
<td>1,5</td>
<td>1,6</td>
<td>1,7</td>
</tr>
<tr>
<td>Number</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>
Initial Measurements

![Graph showing initial measurements with lines A, B, and C representing pressure variation over distance.](image)
## Initial Measurements

<table>
<thead>
<tr>
<th></th>
<th>A vs B</th>
<th>A vs C</th>
<th>B vs C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.05</td>
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</tbody>
</table>
Measurements after Wear and Tear

Garment A
Measurements after Wear and Tear

Garment B
Measurements after Wear and Tear

Garment C
Measurements after Wear and Tear

Median (1q and 3q)
# Measurements after Wear and Tear

<table>
<thead>
<tr>
<th></th>
<th>Fresh vs 1 week</th>
<th>Fresh vs 2 weeks</th>
<th>Fresh vs 3 weeks</th>
<th>Fresh vs 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>B</td>
<td>NS</td>
<td>NS</td>
<td>p &lt; 0.05</td>
<td>NS</td>
</tr>
<tr>
<td>C</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<tbody>
<tr>
<td>Fresh</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>1 week</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
</tr>
<tr>
<td>2 weeks</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.0001</td>
</tr>
<tr>
<td>3 weeks</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.001</td>
<td>NS</td>
</tr>
<tr>
<td>4 weeks</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
<td>p &lt; 0.0001</td>
</tr>
</tbody>
</table>
Conclusion

- Tekscan can be used to measure subgarment pressure.
- The device can be used to measure the pressure profile of garments along the extremities and compare various manufacturers after simulated wear and tear.
- Measuring subgarment pressure is important for future research and in improving lymphedema treatment.
Conclusion

- There are differences between manufacturers in terms of pressure profile.
- In order to achieve a reduced pressure due to simulated wear and tear, longer observation time is required.
- To facilitate clinical use, a new type of sensor needs to be developed.
Thank you for your attention