EFFECTIVENESS OF INTERMITTENT, PNEUMATIC COMPRESSION FOR THE TREATMENT OF VENOUS ULCERS IN SUBJECTS WITH CHRONIC (SECONDARY) LYMPHEDEMA

Results of A Prospective Randomized Clinical Trial

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Secondary Lymphedema

• Caused by:
  – an inadequate lymphatic drainage system due to constriction
  – obliteration from:
    • Surgery
    • Radiation
    • Trauma
    • Untreated CVI
    • Infections

• Can develop immediately post-operatively, or weeks, months or even 10 to 20 years later
Lymphedema

- Accumulation of lymph in the interstitial spaces
- Caused by a defect to lymphatic system

- Abnormal collection of excess tissue proteins
- Edema
- Chronic inflammation
- Fibrosis
- Bacterial & Viral infections
- Cutaneous Manifestations
Diagnostic Features

- Swollen feet
- Deep creases at joints
- “Square toe”
- “Shovel toe”
- Stemmer’s sign
Untreated Lymphedema

- Tissue channels to increase in size and number
- Reduction of oxygen through the transport system
- Interference with wound healing
- A culture medium for bacteria and virus that can result in various infections
- Fibrosis (hardening) of the extremity tissue in chronic inflammatory conditions
Treatment Options

• Medications
  – Antibiotics, diuretics, anticoagulants, pantothenic acid, pyridoxine, hyaluronidase no proven therapeutic value

• Surgery
  – Debulking, microsurgical resection, liposuction
  – do not improve lymph flow
  – many complications

• Complete Decongestive Therapy (CDT)
  – Treatment of choice
Study Design

- Prospective
- Randomized
- One Center Open Label
- Controlled v. Std Care
- Run-in phase
- 32 Week duration

- Primary endpoint
  - Rate of Wound Healing
  - Pain Relief
  - Incidence of Infections

- Secondary endpoints
  - Edema control
  - QOL
Goals of Treatment

- Pain, exudate, odor control
- Wound Healing
- Soften subcutaneous tissue
- Prevent infection
- Decrease limb size
- Increase patient function
- Weight loss
Inclusion Criteria
Hard-to-Heal Venous Ulcers

- Lower leg ulcer due to CVI
- Ulcer size >20 cm²
- Ulcer history >1yr
- Non-Responders
  - (Failed healing with compression alone)
  - Pain index >6
Big Old Wound
Exclusion Criteria

• Ulcer of non-venous etiology
• ABI <0.75
• Wound Infection
• Current use of systemic corticosteroids
• Chemo or radio-therapy
• Subject is presently confined to bed or chair
• Participation in another clinical study
Statistical Design

• Intent-to-treat
• Wound Pain, Leg edema (Fisher’s exact test)
• Time to healing & relative rate of healing (Kaplan-Meier & log rank chi-square test)
Treatments

• IPC plus Compression
  – 4LB* applied twice weekly
  – IPC therapy for 1h bid

• Compression alone
  – 4LB* applied twice weekly

*Profore, Smith & Nephew, Largo, FL
Compression Bandages were applied once weekly at the clinic and once weekly by a visiting nurse. Bandaging was only performed by trained professionals.
Test Agent*

- 4-Chamber, gradient, sequential, pneumatic
- Short Sleeve (19”) 3/4 Sleeve (31”)
- 1 hour bid (morning & evening)
- Pre-set and locked at 50 mmHg
- Therapy sessions in the decubitus position
- Daily diaries
- IPC devices checked every 4 weeks
- Subject / family in-service provided
PDP Software (PictZar™)
Wounds were measured using digital photograph planimetry*

* PicZar™ BioVisual Technologies, LLC
Median Time to Wound Closure by 8 Months (N=52)

Wound Closure Time (Days)
- 4LB N=27
- IPC+4LB N=25

- P=0.031
- P=0.047
- P=0.059

25%  50%  75%  100%
VAS Wound Pain Scores

Study Week

*P<0.05
## Rate of Healing

<table>
<thead>
<tr>
<th>Treatment</th>
<th>4LB</th>
<th>4LB plus IPC</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Closure mm/day ± SEM</td>
<td>1.1 ± 0.4</td>
<td>2.3 ± 0.7</td>
<td>0.026</td>
</tr>
<tr>
<td>N</td>
<td>25</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>
## Leg Edema

### Ankle & Calf Circumference

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline Ankle/Calf (cm)</th>
<th>Week-20 Ankle/Calf (cm)</th>
<th>% Δ Ankle/Calf (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPC plus 4LB</td>
<td>46.5/59.3</td>
<td>37.6/48.2</td>
<td>19.1/18.7</td>
</tr>
<tr>
<td>4LB (Control)</td>
<td>44.7/56.4</td>
<td>39.6/49.2</td>
<td>11.0/12.7</td>
</tr>
</tbody>
</table>
EDEMA

Graph showing the change in circumference (cm) over time (Month) for Ankle and Calf.
Conclusions

• The median time to healing by 8 months was 135 days for the IPC-treated group and 198 days for the control group (p=0.039)

• The rate of healing was 1.1 mm/day for the control group and 2.3 mm/day for the group treated with IPC (p=0.026)

• Compared to subjects treated with compression alone, the group treated with IPC reported less pain at each evaluation point for the first 6 weeks.

• The IPC treated group had greater reduction in leg edema (18% vs 12%)
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