Compression Pumps
use for Lymphedema treatment

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8/11/24

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Objectives

- Understand the role of compression pumps in lymphedema treatment
- Understand the types of pumps
- Understand how to apply compression pumps

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Background

- Lymphedema can be primary (inherited) or secondary - common sequela of cancer, venous disease, etc
- Cancer survivorship improved substantially over recent decades
- As survivorship improves, side effects, including lymphedema increases
- More than 10 million Americans suffer from lymphedema
- Management of lymphedema requires lifetime of burdensome self care
- Compression Devices are a convenient self-management option

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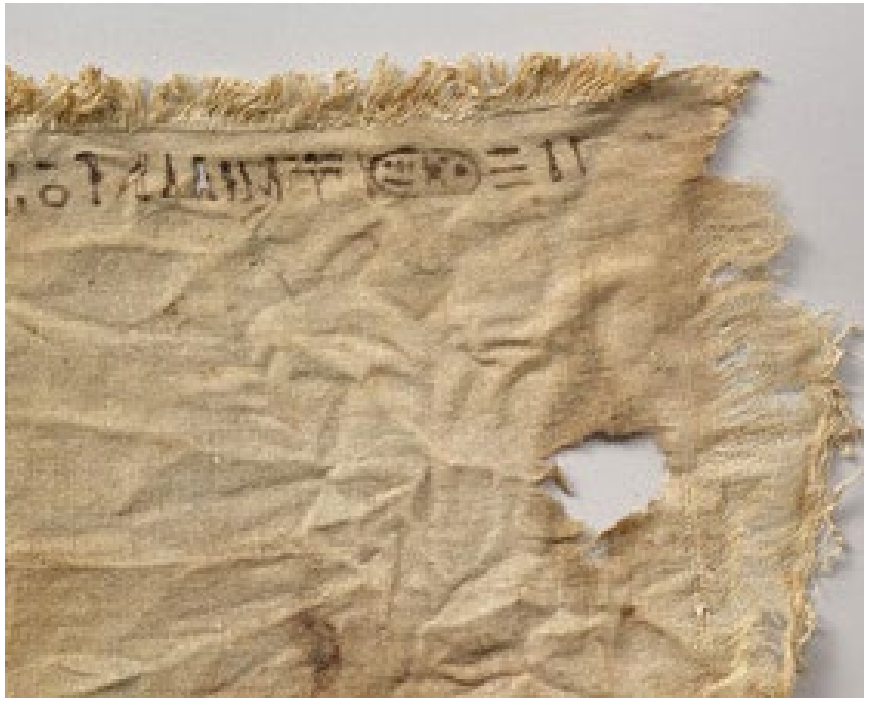
History

Bandages were used in ancient cultures for the treatment of wounds and swellings.



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This knowledge evolved over the years to the many forms of elastic, inelastic/static, wraps, quilted and other "bandaging" forms available today.

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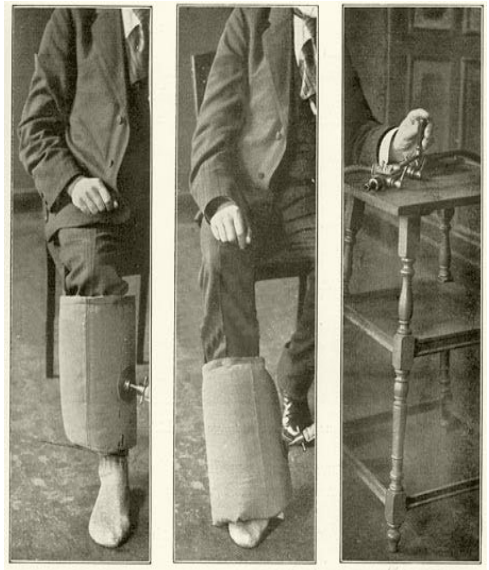
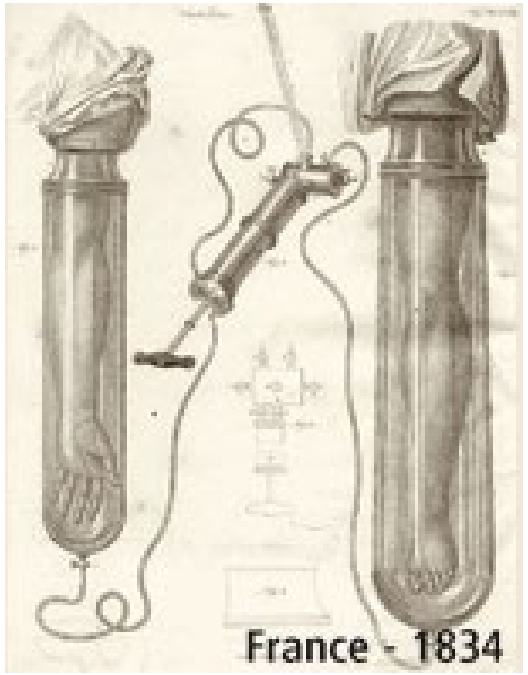
Since the 19th Century Pneumatic Compression is being developed and improved.





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In the beginning…

Single chamber pumps

The profession of lymphedema therapist had not yet been developed.

Compression garments: limited to stockings. Other types of garments were not available.

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In the 70s Prof A. Zelikovsky, and Mego Afek developed the Lympha Press, the first multi chamber gradient device and garments with overlapping chambers for the treatment of lymphedema

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The first Multi Chamber pump

First field tests: 1978 in the USA and Europe

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Case studies demonstrated positive results

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The concept was approved for home care firstly in the USA and later in other countries side by side with the other modalities.

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Effectiveness per literature

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Effectiveness of pumps
What does the research say?

- 2020 article in Elsevier, a study in Chicago of 128 patients, using all pneumatic compression pumps, followed for 3 years. Found that pump improved clinical outcomes, quality of life and functional status, reduced lymphedema related complications and surprisingly reduced BMI (Desai, Shao 2019)
- 2023 Study in Germany compared three groups of patients with leg edema:
  - 4 weeks of pump + MLD
  - 4 weeks of MLD alone
  - 4 weeks of pump alone
- Found no improvement in leg edema except: ankle edema was better in group 1 (pump + MLD), and QOL was better in both groups that used pump (groups 1&3) (Mendoza, Amsler 2023)

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Effectiveness - continued

- 2022 Study @ UPMC followed two groups of leg edema patients over 18 months.
  - Group 1. received standard LE lymphedema treatment
  - Group 2. received standard LE lymphedema treatment + pneumatic compression pump
- Group 2 (ie pump group) conclusions
  - 22% Decrease in infection
  - 14% Decrease in hospitalization rate due to infection
  - 84% Compliance with pump vs. 53% compliance with MLD alone
  - 24% Decrease in therapy need (Soran, Toktas, Grassi, Sezgin, 2022)

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Effectiveness continued

- Lipedema = a form of swelling affecting 11% of the population primarily women and primarily triggered around hormonal change. 2021 article in Lymphatic research divided 33 women with severe lipedema into 3 treatment groups (6 weeks) - measured limb volume, pain, fatigue, endurance:
- Group 1: CDT + exercise
- Group 2: Pump + exercise
- Group 3: Exercise alone
- Conclusion: all three groups improved supporting the hypothesis that exercise (at moderate intensity)is beneficial! Group #1 (CDT + exercise) had a slight better rate of improvement. (Atan, Bahar-Ozdemir 2021)

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Effectiveness continued

- 2022 study in the UK
  - Found that when giving people with leg edema compression pumps lymphedema volume decreased, once the pumps were taken away there was a rebound in lymphedema volume
  - Quality of life improved after treatment with pumps but once removed it worsened (Dunn, Williams, Dolan, Davies 2022)

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Economic cost savings

- 2022 commentary study discussed the economic costs of lymphedema including
  - Direct costs: $2450-$3160 per year of healthcare costs including lymphatic treatment, garments etc.
  - Indirect costs: $2600-$5500 including lost wages and decreased work performance
- They argue that poor adherence to self care contributes to this cost.
- In general, decreased adherence to plan of care in chronic illness declines over time due to discomfort, time commitment and inconveniences
- The article suggests novel non-pneumatic compression device may increase adherence to treatment (Rockson, Mandic, Skoracki, Hock, Nguyen, Shadduck, Gingerich, Campione, Leifer, Armer 2022)

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Types of pumps

- Pneumatic Compression
  - Single Chamber
  - Sequential (basic)
  - Calibrated Gradient (advanced)
- Non-Pneumatic Compression

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Single chamber pumps

The pump inflates a single chamber that encompasses the entire extremity.

The efficacy of these pumps has been recognized as limited.

- Discomfort due to long inflation time
- Lack of directional compression (pushing fluid in all directions) caused inefficient treatment.

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Old fashioned single chamber pumps (E0650)

- With a single chamber sleeve, the pressure is distributed in all directions – up and down.
- It is like squeezing a toothpaste tube in the middle – part of the edema flows distally (the wrong way).
- For these reasons, single chamber pumps are no longer recommended or widely used.

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Sequential pumps

- Sometimes referred to as “basic” pumps
- The pump has a single pressure control that inflates and deflates air chambers in the garment, sequentially.
- Basic pumps are less expensive than advanced pumps, and some insurers will require a trial with these pumps first to see if they are successful in treating the patient’s condition.

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Calibrated gradient compression

- Also referred to as “advanced pumps,” these devices have the ability to set different pressures in at least three places on each garment. This allows adjusting pressure for special considerations such as pain and treatment resistant or fibrotic areas. These advanced pumps can also apply treatment to the torso as well as the extremities.

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Comparison of Sequential ("simple") pumps vs advanced pumps

- 2022 study in Lymphatic Research and Biology 40 participants from the UK with leg lymphedema, both groups used pumps 2x per day 5 weeks set at 40 mmHg
- Group A: graduated sequential pump
- Group B: advanced pump

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Mixed Results

- Both groups had improved lymphedema volume
- Both groups had improved QOL
- Once pumps removed both groups experienced “rebound” both in limb volume and QOL
- There was no difference in QOL between the groups
- BUT the advanced pump was significantly better at reducing leg volume than the sequential one (Dunn, Williams, Dolan, Davies 2022)

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Non Pneumatic Active Compression

- “Hybrid” form of compression
- Does not work by inflating air
- Embeded spring-like segments that contract and relax to provide compression
- Mobile, low profile, light
- 2023 study in lymphatic research and biology recruited 40 women w/lymphedema at the SF Bay area found: improved QOL, improved adherence, limb volume maintained or improved by avg 2% (Rockson, 2002)

Caption

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How to use pumps (all types)

- Frequency/Duration/Dosing:
  - Most manufacturers recommend 2 x per day 7 days per week, 45-60 min per session
  - Literature supports 1x per day. For example: study that divided participants into 3 groups: 1 hour once a day, 1 hour twice a day, 2 hours, twice a day (OUCH!) found no clear difference in benefits between the three groups (Keeley, Riches, Ward, Peter, Franks 2023)

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How to use pumps

- Compression Settings
  - Most pumps can be set at 20-60 mmHg
  - Depends on many factors such as: type of lymphedema (venous, as a result of cancer, lipedema), location of edema, stage of lymphedema, quality of skin (wounds, radiation etc)

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How to use pumps

- What to Wear
  - Most manufacturers suggest wearing light, single layer clothes preferably cotton or other fabric that can absorb perspiration
  - Elastic compression garments are not recommended as they can "bunch up" under the pump and cause irritation
  - Inelastic garment/short stretch bandages can safely be worn under the pump but will alter the carefully calibrated compression applied by the pump
  - Chip/fibrosis pads are sometimes recommended to address specific areas of fibrosis

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THE END

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