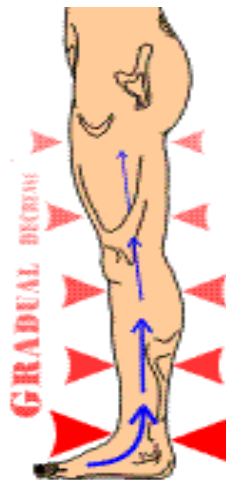


How do Intermittent Pneumatic Compression Devices (IPC's) work and what are the Contraindications?

An IPC is an intermittent pneumatic compression device that is composed of an inflatable garment consisting of multiple pressure compartments that wraps around the arm or leg, and an electrical pneumatic pump that fills the garment with compressed air. The garment is intermittently inflated and deflated with cycle times and pressures that vary between devices.

Pressure gradient

First generation IPC's consisted of an inflatable single compartment pressure chamber that applied a non-segmented uniform and sustained level of compression to the entire extremity. These non-programmable devices did not provide proper pressure distribution or a pressure gradient. To effectively assist the movement of stagnated lymphedematous fluid, a pressure gradient between the lower (distal part - higher pressure) and the upper part (proximal part - lower pressure) of the extremity is imperative; the same principle applied by compression bandages and compression garments. Due to the limited amount of control and lack of appropriate pressure gradient, single-chambered devices should not be used in the management of lymphedema.



Multi-chambered, segmented IPC's are considered to be newer generation compression devices and are equipped with multiple outflow ports on the pneumatic pump leading to distinct segments of the garment that inflate sequentially from the lower part of the extremity to the upper part of the extremity until all segments are inflated. Following this phase, all compartments deflate at the same time.

Two groups of multi-chambered IPC's can be distinguished – those without or limited manual control and non-calibrated pressure, and devices equipped with programmable options and calibrated pressure.

Multi-chambered IPC's without or limited manual control and non-calibrated pressure

In this more traditional group of devices the pressure present in each chamber is the same, or there is a predetermined gradient in pressure in successive pressure chambers, but no ability to adjust the

pressure in each of the chambers independently. The pressure in these pumps is typically determined with a single control on the lowest (most distal) pressure segment and applies a sustained pressure in each chamber as the subsequent pressure chambers inflate.

One concern related to the use of these devices is that the applied pressure on the surface of the skin may significantly exceed the pressure value displayed on the device itself (1). Considering the anatomical and physiological facts of the lymphatic system, it becomes evident that excessive pressure to the skin may have a harmful, damaging effect on the superficial lymphatic structures.

The pressure garment used with these devices covers only the extremity and has no appliances covering the adjacent part of the torso. Subsequently lymphedematous fluid that is moved from the extremity may accumulate at the top of the limb, resulting in the formation of hardened tissue (fibrotic ring), or may cause the swelling of adjacent parts of the torso (chest, trunk, abdomen) previously not affected by lymphedema. In lower extremity lymphedema the displaced fluid from the leg may accumulate in the genital area (2).

Considering the fact that lymphedema of the extremities is often associated with swelling of the adjacent body quadrant and/or external genitalia (3), these devices are not well suited for the management of lymphedema.

Multi-chambered IPC's with programmable options and calibrated pressure

Advanced segmented devices with calibrated gradient pressure are characterized by a manual control on at least three outflow ports of the device that can deliver an individually determined pressure to each compartment of the unit. It is possible to make manual adjustments in the pressure in the individual compartments and/or the length and frequency of the inflation cycles. These devices are also known as Type III pumps; the Center for Medicare and Medicaid Services (CMS) assigned the HCPCS code EO652 to these devices.

The advantage of this system is that the level and location of the compression can be adjusted to meet the patients' specific circumstances in regard to comfort (pressure tolerance, pain) and the need to concentrate on specific areas affected by lymphedema, or on areas with excessive fibrotic tissue formation. Non-adjustable and non-programmable units do not offer this level of adjustability, which may have negative effects on patients' compliance, specifically if sustained pressure is not well tolerated. The programmability of the pressure profile in segmented devices with calibrated gradient pressure more closely mimics manual lymphatic drainage techniques and reduces the danger of potentially damaging effects on the superficial lymphatic structures.

More sophisticated models provide additional appliances that allow for treatment of the torso. As mentioned above, lymphedema of the extremities is often associated with swelling of adjacent body parts, such as the chest, trunk or abdomen. These more advanced IPC systems can address this issue and assist in clearing of these areas prior to stimulate the extremity, thus preventing the danger of fibrotic cuffs, or the onset of additional swelling in other body areas.

What are the recommended pressure levels and treatment times in programmable and calibrated pumps?

Unfortunately, consensus of the proper pressure level in IPC's for the treatment of lymphedema is lacking. In general it can be said that the pressure level should be adjusted to the patient's level of tolerance and response to treatment. Careful instruction of the patient in the use of these devices and surveillance by a practitioner trained on a specialist level in these devices is required. A review of the literature suggests that peak inflation pressure of 25 to 60 mmHg may be sufficient for most patients (4,5).

There is also no standard consensus on the frequency of IPC treatments. Depending on the individual situation, treatment duration of 30 minutes to two hours (one hour twice a day) is generally recommended. Careful guidance by a practitioner with knowledge in lymphedema treatment is mandatory to determine optimal treatment frequency.

When are IPC's contraindicated?

The following contraindications are listed in the Lymphedema Framework's international consensus document "Best Practice Guideline for Lymphedema" (5):

- Non-pitting chronic lymphedema
- Known or suspected deep vein thrombosis
- Pulmonary embolism
- Thrombophlebitis
- Acute inflammation of the skin (erysipelas, cellulitis)
- Uncontrolled/severe cardiac failure
- Pulmonary edema
- Ischemic vascular disease
- Active metastatic diseases affecting the edematous region
- Edema at the root of the extremity or truncal edema
- Severe peripheral neuropathy

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References:

- (1) Segers P, Belgrado JP, LeDuc A, LeDuc O, Verdonck P. Excessive pressure in multichambered cuffs used for sequential compression therapy. *Phys Ther.* 2002; 82(10):1000-1008
- (2) Boris M, Weindorf S, Lasinski B. The risk of genital edema after external pump compression for lower limb lymphedema. *Lymphology* 1998;31 (1):15-20
- (3) Zuther JE. *Lymphedema Management: The Comprehensive Guide for Practitioners* 3rd ed 2012. New York NY: Thieme Medical Publishers, Inc. Page 63
- (4) Feldman JL, Stout NL, Wanchai A, Stewart BR, Cormier JN, Armer JM. Intermittent Pneumatic Compression Therapy: A Systematic Review. *Lymphology* 45(2012) 13-25
- (5) International Best Practice Guideline for Lymphedema
http://www.woundsinternational.com/media/issues/210/files/content_175.pdf (page 35)