IPC Use in Lymphedema: Physiological Considerations  
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Interstitial fluid homeostasis is accomplished by a proper balance between the amount of fluid and protein crossing from blood capillaries into the interstitium and the amount removed via blood capillary and post-capillary re-absorption and the amount removed via lymphatics. Lymphatic pathways start with interstitial content taken up by lymphatic capillaries with lymph fluid then transported via contracting lymphangions that serve to progressively propel lymph through converging lymphatic vessels to finally dump into the venous system. Dysfunction in the lymphatic system or its pathways, such as occurs with lymph vessel or lymph node injury or removal, diminishes lymph removal of interstitial contents, which if serious enough, leads to an accumulation of excess interstitial fluid and protein or lymphedema that unless treated tends to worsen.

Intermittent Pneumatic Compression (IPC) is sometimes used in the initial short-term intensive phase of lymphedema treatment in concert with manual lymphatic decongestion (MLD) and is also used as a central component of the life-long, in-home patient-dependent maintenance phase to sustain gains achieved during the intensive phase and to limit lymphedema progression via a daily program of care and IPC use. IPC devices come in various flavors that may be categorized as to their features. Basic IPC devices have few adjustments, are not programmable and may not provide adequate sequential compression. More advanced IPC devices are pressure calibrated with physiologically designed sequential compression modes and software adjustable to meet varying patient needs including tailored compression in areas that are painful, ulcerated or fibrotic. There are important differences to be considered even among advanced IPC devices. These differences may be viewed in terms of the likely ability of an IPC device to perform in a way that is consistent with the physiological underpinnings of the lymphedematous condition. At least three physiological considerations in this regard are the IPC compression pattern, its temporal progression and its pressure magnitude.

Regarding pattern at least two approaches exist, one in which segmental compression pressure rises rapidly for a short duration and then is released, these are here referred to as “work and release” patterns. The other is a pattern in which segment compression pressure is increased and held until all subsequent segments are compressed and only then are all segment compressions released. This pattern is here referred to as “squeeze and hold”. Based on physiological considerations that include lymphatic capillary uptake of interstitial fluid during compression, stimulation of propulsion within patent lymphatic pathways and effective maintenance therapy, a “work and release” pattern seems to be the more desirable approach. If on the other hand there are no viable patent lymphatic pathways and the interstitium has a very low hydraulic conductance, as may be the interstitial state in very advanced stages of lymphedema, then the “squeeze and hold” pattern may be more effective for moving fluid through the interstitium to link up with functional lymphatic pathways.

The only compression temporal progression sequence that is fully consistent with physiological considerations and prevailing pressure-flow hydrodynamics is one that uses initial central/proximal clearance preparation phases prior to starting a distal to proximal compression sequence. In well designed advanced IPC systems this clearance function is achieved using torso and trunk compression garments that function in concert with limb compression chambers applicable to both upper and lower extremity lymphedema. With respect to pressure magnitudes it appears that lower pressures are indicated to facilitate lymph movement in functioning lymphatics, to minimize inhibition of lymph filling during compression, to minimize potential injury due to higher pressures and to provide a comfortable treatment experience for patients. Higher pressures may be indicated to produce directional interstitial fluid movement especially for low conductance interstitium.

In conclusion, IPC use in lymphedema should function in a manner that is consistent with physiological considerations that include: 1) initial clearance of central/proximal territories, 2) subsequent distal-to-proximal progressive propulsion, 3) using compression patterns and pressures that will minimally inhibit a) lymph capillary uptake, b) lymphatic intrinsic active pumping and c) lymph – venous uptake and drainage and 4) facilitate lymph vessel and tissue lymph flow via Impulse – like progressive compression and arterial-lymphatic interactions that tend to occur at lower compression pressures.