Optimum Intermittent Pneumatic Compression Stimulus for Lower-limb Venous Emptying

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Objective: intermittent pneumatic compression (IPC) of the foot (IPC_{foot}), calf (IPC_{calf}) or both ($IPC_{foot+calf}$) augments calf inflow, and improves the walking ability and peripheral haemodynamics of claudicants (IPC_{foot}, $IPC_{foot+calf}$), largely due to venous outflow enhancement. This cohort study, using direct pressure measurements in healthy limbs, determines the optimal combination of frequency (2-4 impulses/minute), applied pressure (60-140mmHg), mode (IPC_{foot} - IPC_{calf} - $IPC_{foot+calf}$) and delay time of calf-to-foot impulse (0 s-0.5 s-1 s) that enables IPC to generate an almost complete and sustained decrease in venous pressure.

Results: (a) IPC_{foot} at 120 and 80mmHg generated lower venous pressure than that with 100 and 60mmHg ($p = 0.036$) respectively, for 2-4 impulses/minute; venous pressure differences between applied pressures of 140 and 120mmHg or between 80 and 100mmHg were insignificant. (b) Venous pressure with IPC_{calf} at 80mmHg was lower than that with 60mmHg ($p = 0.036$) (2-4 cycles/minute); differences in venous pressure between applied pressures of 140 and 100 mmHg or between 120 and 80mmHg were insignificant. (c) At applied pressures 60-140mmHg, $IPC_{foot+calf}$ with one-second delay generated lower venous pressure than that with half-second delay ($p = 0.036$), the latter being more efficient than zero delay; increasing applied pressures produced lower venous pressure, but differences were small.
Venous pressure decreased with increasing IPC frequency (from 2 to 3-4/minute), at applied pressures 60-140mmHg.

Conclusions: $IPC_{foot+calf}$ at applied 120-140mmHg, a frequency of 3-4 impulses/minute and one-second delay, provided the optimum intermittent pneumatic stimulus.