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Graduated compression is not mandatory

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Compression therapy (CT) must be graduated, with the highest pressure at the ankle progressively decreasing toward the knee and thigh. This is one of the fundamental principles of CT, based on the idea that graduated compression facilitates blood drainage from the foot to the general circulation. However, this only applies when a person is lying down or stationary. For someone in a recumbent position, the higher pressure at the ankle promotes venous outflow toward the knee and thigh. In a standing individual, the higher intravenous pressure at the ankle progressively decreases toward the knee and thigh, and can be effectively countered by a corresponding graduated external pressure. Consequently, graduated compression is an essential characteristic of medical compression stockings (MCSs). If MCSs lack a graduated pressure profile, they cannot obtain the quality certification from regulatory bodies, which is necessary for reimbursement from national health systems or insurance companies in many countries. However, in ambulatory individuals, calf muscle contractions induce physiological intramuscular pressure peaks as high as 200mmHg during walking and around 260mmHg during running.[1] This pressure temporarily occludes the veins at the calf rather than at the ankle level (where muscles transition into tendons), creating an inverse pressure gradient with each step. Additionally, simultaneous pressure measurements in superficial veins have shown a greater reduction in ambulatory venous pressure in the foot compared with the calf in both normal individuals and those with superficial venous incompetence.[2] These findings suggest that during walking, the proximal internal pressure can exceed the distal pressure. Therefore, a graduated internal pressure profile does not occur even under physiological conditions, raising questions about the necessity of mandatory graduated compression therapy. In contrast, higher pressure at the calf level, where muscles and the venous reservoir are located, can enhance the venous pumping function.

Although limited, we have experimental and clinical data showing that progressive compression (higher compression pressure at the calf than at the ankle) can be more effective than graduated compression in improving venous haemodynamics as well as clinical symptoms and signs in both healthy volunteers and patients with chronic venous disease (CVD). Indeed, strain gauge plethysmography demonstrated an increase in venous pumping function when using elastic stockings with a progressive pressure profile.[3] Despite a significant improvement in ejection fraction compared with graduated compression, a single progressive elastic stocking did not restore the ejection fraction to its normal range. This can only be achieved by superimposing two progressive elastic stockings,[4] which have been proven to be more effective than a single stocking and to restore optimal venous haemodynamics. Furthermore, changing the progressive pressure profile to a graduated one by adding a graduated elastic stocking only at the ankle level did not yield further improvement in ejection fraction, but instead demonstrated a slight and non-significant reduction. Finally, an inelastic bandage with a graduated pressure profile can restore the ejection fraction to its normal range; however, when the same inelastic bandage is

applied to exert progressive pressure, its effectiveness in improving the ejection fraction is significantly higher.[5] From a clinical perspective, progressive compression has been proven to be more effective than graduated compression in preventing occupational oedema in normal volunteers who stand or sit continuously during their work shifts.[6] In a clinical randomised study involving 401 patients with moderate-to-severe CVD CEAP (C2s to C5),[7] MCSs with a progressive pressure profile were proven more effective than graduated MCSs in reducing symptoms and signs CVD-related. In particular, they have been shown to be more effective in reducing pain and heavy leg sensation, and are easier to put on and take off.[8] In another study, the same authors demonstrated that patients with CVD and concurrent arterial disease tolerated progressive stockings well. This high tolerance is explained by the reduced pressure of these stockings at the foot and ankle, where the effects of arterial impairment are more pronounced.[9]

Adjustable compression wraps (ACW) provide additional indirect evidence that progressive pressure can effectively work, even in patients with venous leg ulcers (VLUs). These devices do not cover the ankle and the retromalleolar space where VLUs are frequently located. An elastic stocking with low pressure typically covers this area. Consequently, they definitely exert progressive pressure, as their pressure at the calf is considerably higher than at the ankle. Nevertheless, ACWs have been shown to be very effective in promoting VLU healing, sometimes even more so than traditionally applied bandages.[10–12]

In conclusion, graduated compression has been shown to be effective in many clinical indications and is widely regarded as the gold standard. However, a graduated pressure profile must not be the dogma of of compression, as, conversely, progressive compression has been shown to be effective from both haemodynamic and clinical perspectives. Unfortunately, data comparing graduated and progressive pressure are few and sparse, as progressive compression is, in some way, banned from clinical use by German and French regulatory standards for medical compression stockings such as Reichs-Ausschuß für Lieferbedingungen (RAL) and Association Française de Normalisation (AFNOR). The avaliable data come from prototype stockings or compression bandages intentionally applied to provide a progressive pressure. The increasing use of devices exerting a non-graduated compression will provide us with additional and more solid data. JWC

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