Practitioners are generally advised not to use short-stretch bandages on patients who are immobile. Ellie Lindsay and colleagues suggest that this advice reflects confusion about calf-muscle function.

**KEY WORDS**

Immobility

Sub-bandage pressure

Calf-muscle pump

**REFERENCES**


Short-stretch compression bandages have been shown to be as cost-effective and efficient as other compression systems in healing venous ulcers, independent of associated factors (Scriven et al, 1998; Nelson, 1996). However, as they do not contract around a limb they do not exert pressure during inactivity (resting pressure) (Klose Norton, 2003). But their stability creates a high resistance to stretch when pressure is applied through internal muscle contraction and joint movement (working pressure) (Tuckwood, 1996).

The working pressure causes both the superficial and deep veins to constrict, but only when the muscle pump is working. The action of the muscle pump is necessary for effective elimination of venous stasis. The mode of action of both short-stretch and multilayer compression bandaging is given in Box 1.

It is has been considered inadvisable to use short-stretch compression bandages in immobile patients because of the low resting pressures (Tuckwood, 1996). However, the definition of immobility may have different meanings for individual assessors.

**Short-stretch compression therapy**

External compression can help to minimise or reverse the effect of venous hypertension by directing fluid from the interstitial spaces back into the vascular and lymphatic compartments. At the same time, exercising the calf-muscle pump and foot pump can return blood to the heart, reducing the pressure in the feet. The amount of exercise required to activate the foot pump and calf pump is investigated in this paper.

Danielsen et al (1998) compared sub-bandage pressures produced by short-stretch and long-stretch bandages. The minimum and maximum sub-bandage pressures in ambulant patients did not differ so they concluded that short-stretch bandages did not produce higher working pressures. Pressure decreased in the supine position in both groups. This challenges the concept that long-stretch bandages provide higher working pressures than short-stretch bandages.

**Foot pump and calf-muscle pump**

An understanding of the action of the foot pump and the calf-muscle pump can help practitioners to interpret the term immobility. The venous foot pump consists of large venae comitantes of the lateral plantar artery, which respond to the immediate effects of weight-bearing rather than muscular movement (Hutcheson, 1999).

The plantar arch is the arch in the sole of the foot formed by the anastomosing branches of the plantar arteries. The plantar venous plexus comprises the lateral plantar veins, saphenous veins, the plantar venous plexus vein, posterior tibial vein and the superficial dorsal veins.

When weight is applied to the sole of the foot, the plantar arch is flattened. The resulting longitudinal stretching of the veins allows the blood to be pumped along the long and short saphenous veins into the deep calf veins, even when the patient is in the upright position. Phlebography has shown that weight bearing under the instep empties the deep plantar veins, whereas weight bearing on the heel and metatarsal heads empties the whole system (Gardner and Fox, 1983). Gardner and Fox also found that ‘weight bearing on a flaccid hemiplegic leg with the knee locked also caused flow in the femoral vein’, indicating that the foot pump may be functional in paraplegic legs. It has also been suggested that stretching the arch without weight bearing may be sufficient to empty the veins (Gardner and Fox, 1983).

White et al (1996) studied the venous outflow of the leg, focusing on calf-muscle function and the action of the foot pump. They discovered that the plantar venous plexus fills when the foot is dependent and empties as soon as weight is placed on the arch of the foot. Blood is collected in the plexus veins from the deep spaces of the foot and superficial veins, and is transported into the deep venous system. Outflow from the plantar venous plexus is independent of calf-muscle contraction.

The calf-muscle pump relies on muscle action to ‘squeeze’ and release the deep veins, creating pressure and encouraging the return of blood to the heart. McMullin et al (1989) investigated the relationship between the calf-muscle pump and the foot pump. The study showed that, when calf-muscle pump action is poor, the foot pump is a more effective means of venous emptying. The researchers concluded that the foot pump is as important as the calf-muscle pump in facilitating effective venous return.

The foot pump is activated when a person transfers from bed to chair. Assessment of a patient with impaired mobility should, therefore, take this into account before describing their condition as restricted or immobile.

**Assessing mobility**

Restricted mobility can be caused by various factors. Anyone at risk, regardless of age, can experience changes in their muscles and joints following prolonged periods of immobility.

A holistic assessment of an older person with a leg ulcer who has restricted mobility requires good observational skills, knowledge and time. This may involve a multidisciplinary approach to treating the...
cause of the restricted mobility and any associated factors while encouraging the patient to undertake simple foot/ankle/lower limb exercises at regular intervals throughout the day.

A patient’s mobility can be measured by a simple tool (Table 1). It has not yet been validated but could be incorporated into an initial wound assessment document for defining immobility.

Patients with a score of seven will have no foot pump action, so they can be described as being immobile. However, venous return will be promoted with foot exercises, such as those that stretch the plantar arch. If a patient with a score of seven achieves venous return, then progression to a higher score can be measured at a later date. The tool provides a simple method of observing evidence of improved mobility following interventions such as education and physiotherapy.

Patients with scores of two to six will have foot-pump action and some calf-pump involvement. A score of one denotes full foot pump and calf pump action.

The tool offers a definition of immobility and suggests that an ‘immobile’ person is unable to support his or her own weight or move without assistance. In this instance, neither the foot pump nor the calf-muscle pump can function. However, individuals with restricted mobility will be able to use the foot and calf-muscle pump. Mobility and haemodynamics within the leg have never been reviewed independently and individuals with even the lowest mobility may have effective muscle pumps.

Clinical experience In Eastbourne NHS Trust a multidisciplinary group reviewed the available evidence on the efficacy of the different types of compression bandages and found little difference between them. The group, therefore, decided to purchase the most cost-effective type. The choice was short-stretch bandages.

This had implications for patients classed as immobile. However, we have found that immobile patients with venous ulcers appear to heal almost as rapidly as those considered to be mobile. We believe that if short-stretch bandages are as effective as other methods of compression, there is no reason that they should not be used with patients who are immobile.

Conclusion The foot pump plays a vital role in venous return and its importance in relation to short-stretch bandages should not be discounted lightly. Providing there is action to promote the foot-pump mechanism, either through standing and transferring, or through stretching the plantar arch, venous return can be effective. It is not our intention to state that patients’ ulcers will heal under short-stretch compression therapy but we hope to stimulate debate on mobility in relation to the use of short-stretch bandages.

Table 1. Ambulatory Assessment Chart

<table>
<thead>
<tr>
<th>Level of Mobility</th>
<th>Score</th>
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<tbody>
<tr>
<td>Immobile: Unable to move unaided, either in bed or in a chair. Cannot support own weight even with assistance.</td>
<td>7</td>
</tr>
<tr>
<td>Assisted mobility: Needs physical assistance from another person(s)</td>
<td>6</td>
</tr>
<tr>
<td>to walk or move. Can transfer with assistance.</td>
<td>5</td>
</tr>
<tr>
<td>Restricted/limited mobility: Able to transfer with assistance. Can walk a few steps but limited by physical or psychological problems such as shortness of breath, pain, falling sight, fear of falling, agoraphobia.</td>
<td>4</td>
</tr>
<tr>
<td>Poor mobility: Poor walking pattern, shuffling gait, decreased stride length, poor posture. Muscle weakness, deformity.</td>
<td>3</td>
</tr>
<tr>
<td>Independent with aid of equipment: Able to achieve independence with specific (daily living) equipment.</td>
<td>2</td>
</tr>
<tr>
<td>Independent with supervision: Physically able to support own weight but needs supervision and/or prompting to ensure correct use of equipment, walking pattern or orientation.</td>
<td>1</td>
</tr>
<tr>
<td>Independent mobility: Able to walk, transfer and lie down/get up.</td>
<td></td>
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Table 1. Mode of Action of Short-Stretch and Multilayer Bandages

Short-Stretch Bandages

Semi-rigid cylinder. Stays in place when calf muscle expands against the rigid bondage sides. This redirects the working force back into the leg and acts on the venous system (Eagle, 2001). This means the bandages do not yield to muscle expansion. The force works on the bondage and is dissipated by stretching the bondage.

Multilayer (or Four-Layer) Bandages

Elastic cylinder. Expands with the calf muscle and contracts as the muscle relaxes, creating increased force within the leg and acting on the venous system.

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