

# IMPACT OF COMPRESSION THERAPY ON CHRONIC VENOUS DISEASE

Chronic venous disease is known to affect up to 50% of the adult population and it is estimated that 1% of individuals will suffer from venous leg ulceration during their lifetime (Venous Forum of the Royal Society of Medicine et al, 2011). Venous leg ulcers are associated with a prolonged healing trajectory and frequent recurrence, and owing to an ageing population, their prevalence is increasing (Woo and Cowie, 2013). For those affected, venous leg ulcers have a substantial impact on quality of life and on healthcare services because of the cyclical healing and recurrent nature of chronic venous disease (Scottish Intercollegiate Guidelines Network [SIGN], 2010). This article will discuss the benefits of using compression therapy for the management of venous leg ulcers, as well as exploring the impact of poor practice in relation to healing outcomes.

*“The prevalence of chronic venous disease does not appear to be decreasing despite evidence that compression therapy can be effective if applied correctly and tolerated by patients.”*

The key to successful management of chronic venous disease is the appropriate application of compression therapy. Successful healing outcomes are unlikely to be achieved if compression therapy is substandard and poor healing results in a chronic healthcare burden, in particular, for primary care services. Underuse of compression therapy represents lost opportunities for healing wounds and improving patients' quality of life (Wounds International, 2013).

The benefits of compression therapy for the management of venous leg ulcers will be discussed and the impact of poor practice on healing outcomes will be explored.

## **Pathophysiology of venous disease**

It is important for care providers

to understand the underlying pathophysiology of the venous disease process to provide effective treatment.

In healthy individuals, venous blood flow in the lower limbs has to overcome the natural force of gravity unless a person is lying flat. When a person rises to a standing position from lying down, pressure in the venous system increases. However, during movement, the pumping effect of the calf muscle reduces venous pressure. Venous blood flows from the superficial veins through perforator veins to the deep venous system, eventually returning to the heart. Valves in the lumen of the veins prevent the backflow of blood and maintain low venous pressure; however, the prevention of backflow relies on active calf muscle pump activity (Wounds International, 2013).

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If this pump mechanism is reduced or fails as a result of inactivity, paralysis, varicose veins, damaged deep veins due to venous thromboembolism, trauma or venous obstruction, venous pressure increases. This, in turn, causes pooling of venous blood in the distal veins, increased permeability of the vessels, which causes leakage of fluid and proteins and venous hypertension which can eventually lead to venous leg ulcers (*Figure 1*). It is this sustained increase in venous pressure within the deep and superficial venous system that leads to venous insufficiency and unless this is reversed, the condition becomes chronic and is much harder to reverse at this stage. The earlier this condition is recognised the sooner preventative actions can put in place.

The aim of treatment, therefore, is to reverse the venous hypertension through the application of compression therapy.

### **Compression therapy options**

The mainstay of venous leg ulcer management is the use of four-layer compression therapy (Nelson and Bell-Syer 2012; O'Meara et al, 2012). However, alternatives in the form of two-layer bandage systems and hosiery kits have also been used effectively for some patients with venous leg ulcers (Adderley and Stubbs, 2014).

Effective compression therapy enables the creation of an enclosed system that allows internal pressures to be evenly distributed in the leg (Wounds International, 2013). Compression that is correctly applied externally to the lower leg increases the pressure on the skin and underlying structures to counteract the force of gravity previously mentioned. This, in turn, actively promotes the flow of venous blood back up the leg, reducing the venous hypertension. It is important to

remember that using a compression system alone does not guarantee a level of compression as the pressure can vary depending on limb size and shape, level of calf muscle activity, as well as the bandage width, degree of overlap and the tension of the application (Vowden and Vowden, 2012). These specific factors can be influenced by the skill and expertise of the health professional undertaking the therapy especially in the context of assessment and adjustment of the therapy to meet the needs of the individual patient.

A wide choice of therapy options is now available to suit a wide variety of patient needs. For some staff, however, the terminology used to describe the extended range of available therapies can be confusing. Compression bandages, hosiery kits and compression hosiery are all used in the management of chronic venous disease (*Figure 2*). Compression bandaging is most commonly used to treat active ulceration, with compression hosiery used as a preventive modality and for post-ulcer healing.

**Figure 1. Chronic venous leg ulceration.**



**Figure 2. A selection of compression therapies available to the author.**



Compression bandages are available as a single component or as a combination of multiple components. They can be inelastic (short stretch) or elastic (long stretch); however, more recently combinations of both materials have been marketed (Anderson and Smith, 2014). An inelastic bandage has high stiffness compared with an elastic bandage, and this stiffness is assessed using the static stiffness index (SSI), which compares the difference between the working and resting pressures in the venous system.

This is measured by recording the pressure at the interface between the compression therapy system and the skin when the patient is lying down

and again when they are standing. The SSI is the difference between the two measurements (Partsch, 2005). Compression therapy systems such as two- or four-layer compression bandages when applied to a leg usually function as a high stiffness system and will produce higher pressures during standing and lower pressures when lying down compared to one that has a low SSI, such as a long-stretch bandage (Wounds International, 2013). One of the benefits of a high SSI bandage is that oedema in a limb will reduce rapidly, however, the bandage will become loose more quickly and need to be reapplied more frequently, as a consequence. This can be daily in the first instance until oedema has reduced.

**Figure 3. Trauma to the lower limb caused by inappropriately applied compression bandaging.**



Two-layer compression hosiery kits can be used to manage active leg ulceration in selected patients, such as those with small, low-exuding wounds (Vowden and Vowden, 2012). However, difficulty may be experienced in applying them over wound dressings. Adhesive dressings may help, however, caution is required that the adhesive properties do not cause an allergic or irritant reaction to vulnerable skin. The kits have an inner stocking layer which provides approximately 10 mmHg pressure and a higher pressure stocking that is applied on the top. The inner layer can assist in the application of the outer stocking as it allows it to glide over the surface more easily than against the skin on the leg. They are designed to give pressures of 30–40 mmHg pressure at the ankle although this is dependant on ankle circumference (Anderson and Smith 2014). A study by Ashby et al (2013) found two-layer hosiery to be a viable alternative to a four-layer bandage, therefore, it is worth considering for some patients where independence and concordance are particular issues.

Compression hosiery is the 'gold-standard' mainstay of venous leg ulcer prevention, but patients require accurate measurement of the limb, according to manufacturers' guidance, and the hosiery needs to be able to stay in place in order to be effective. Hosiery is available ready to wear and made to measure, and is available in below-knee, thigh and full-leg lengths. As hosiery can provide pressures ranging from 14 mmHg to greater than 49 mmHg — depending on whether or not it is British classification (which provides upto 35mmHg) or the German RAL classification (which exceeds 49mmHg) — the prescriber must be aware of the individual patient's requirements.

Hosiery is constructed in one of two ways: circular or flat knit. Circular knit produces a seamless tube and



is commonly used for prevention of uncomplicated venous hypertension. It can, however, cut into the skin folds and may be less adaptable to changes in limb shape, whereas flat knit produces hosiery with a seam, and is more commonly used for made-to-measure garments due to its stiffness and, therefore, its ability to reduce and control oedema (Anderson and Smith, 2014). Some patients find the stiffer hosiery more difficult to apply, however, it is more effective in reducing oedema in a similar way to the bandage systems previously described.

Choosing the correct compression must take into account physical and psychological factors, such as lifestyle, ability to tolerate the compression levels, the need to be able to 'self manage' and mobility in order to achieve concordance, healing and prevention of recurrence.

Despite the wide range of compression therapy available, there is evidence that it is not always used effectively for venous leg ulcer management or for the prevention of recurrence (Petherick et al, 2013).

### **The impact of compression therapy**

A patient's ability to tolerate compression bandages is multifactorial and complex, and includes factors such as pain, inability to wear normal shoes, lifestyle factors, social support and mobility. Concordance (process and outcomes of treatment) focuses on factors that might affect patient choice to follow a particular treatment regimen (Wounds UK, 2014).

It has been suggested that non-concordance with treatment ranges from 9.7–80% in real world studies (Moffatt et al, 2009) with

numerous factors (mentioned above) being proposed to explain these variable levels.

The Royal College of Nursing's (RCN) clinical practice guidelines (2006) suggested that compression therapy is often used sub-optimally in practice because of a lack of knowledge and confidence in assessing patients using Doppler ankle brachial pressure index (ABPI) measurement and applying compression bandaging. SIGN guidance (2010) recommends that compression should only be applied by staff that have had appropriate training, while Martin and Duffy (2012) noted that nurses in the community often practice in isolation, which may hinder their ability to access, understand and incorporate the most up-to-date research into everyday practice.

This is supported by Petherick et al (2013), who suggested that from a UK primary care database, only 20% of patients with confirmed venous leg ulcers were receiving compression therapy. It is, therefore, essential that all staff, registered and non-registered, managing patients with venous leg ulcers undergo training in the assessment and management of this chronic condition in order to understand the underlying pathophysiology and the treatment options available.

Optimal healing outcomes rest on the provision of consistent levels of compression and it is recognised in the literature that the ability of bandagers can differ, and patients might become anxious when there is inconsistency in their care (Guest et al, 2013). Education and training is usually provided for all community nurses, which consists of leg ulcer assessment, including Doppler assessment and ongoing management, which includes the effective use of compression therapy.

Specialist leg ulcer clinics are recommended as the optimal setting for the community treatment of venous leg ulcers where care is consistent and based on best practice (SIGN, 2010). However, in some areas of the UK, such services are not available and patients are still seen in their own homes or in a GP practice. It is also suggested that all healthcare practitioners need to work as part of a multidisciplinary team to optimise prevention, management and maintenance therapy in venous disease and chronic oedema (Wounds UK, 2015). In some areas of the country, however, this may not happen and may be dependent on how leg ulcer services are commissioned.

Chamanga (2014) has suggested that wrongly applied bandages that are not easily tolerated by patients is a common management problem. Tissue damage can occur as a result, especially along the tibial crest and the prominent anterior edge of the tibia running the length of the lower leg (*Figure 3*). The area around the medial malleolus is also considered to be vulnerable. This problem can be addressed through the application of additional padding, but once an area of tissue is damaged, there may be a reluctance on the part of both patients and clinicians to reapply the compression in case further damage occurs. Reassessment of lower-limb blood flow using Doppler ultrasound should also be considered if pain and tissue damage occur to exclude the presence of arterial disease.

Patients' symptoms can influence the management plan, with pain and limb discomfort cited as the main reasons why compression therapy is poorly tolerated (Briggs and Flemming, 2007). Briggs and Closs (2003) found that pain caused by compression bandaging has been

reported to be more severe in the first week following application and reduces in subsequent weeks as the ulcer heals. This is important information to share with the patient as it may be that additional analgesia is required in the early stages of treatment in order to manage the pain experienced and increase bandage tolerance. The ongoing assessment of pain levels using visual analogue, numeric rating or verbal rating scales (Wells et al, 2008) are essential, however, to ensure that the pain is not related to other factors such as infection or reduced blood flow.

A thorough pain assessment should be undertaken to identify specific elements of the pain, such as times, duration, influencing factors and changes to the management plan that have been implemented. With the choice of bandage systems now available for venous leg ulcer management it may be that a different bandage, such as a short-stretch system, may reduce the pain in particular, at rest and at night, owing to its ability to provide a low resting pressure.

If patients experience pain with a hosiery kit, it may be useful to try a bandage system instead. In a study by Ashby et al (2014), which compared the clinical and cost-effectiveness of four-layer bandaging with two-layer compression stockings, the authors found no difference in healing rates between the two systems, with hosiery having a 95% probability of being the most cost-effective. It was reported, however, that more patients changed back to bandages from the stocking group, suggesting that stockings were less comfortable.

A reduced level of compression can be applied if pain is experienced, however, this will ultimately affect the time it takes to heal the ulcer.

Building up the level of compression over time can be effective, especially once the patient has confidence in the bandage system. This can be achieved through the application of a multi-layer component bandage, which provides a lower level of compression, such as a K-Plus® (Urgo Medical), which provides 17mmHg pressure and is often used as a third layer of a four-layer compression system.

The impact of a bandage system on a patient's lifestyle can also lead to patients not following the management plan. Compression bandage systems can be bulky and, as such, are unappealing due to the restrictions in footwear and clothing. If poorly applied, they can also affect the mobility of the ankle. Patients may wish to wear their current footwear, which may be challenging to achieve when there are multiple bandage layers in place. In such cases, consideration should be given to the hosiery option.

Compression hosiery can also decrease the patient's reliance on health workers, which is a benefit for some patients. However, if application is a problem owing to arthritis or poor hand mobility and strength, this has to be considered within the management plan.

### Summary

Venous leg ulcer management remains a resource-intensive service for many organisations and in the UK venous leg ulcer management costs between £168–198 million (Posnett and Franks, 2007). The prevalence of chronic venous disease does not appear to be decreasing, despite evidence that compression therapy can be effective if applied correctly and tolerated by patients. Prevalence increases with age and affects up to 2% of the population over 80 years old and, at any one time, approximately 0.1–0.3% of the UK

population has an active venous leg ulcer (SIGN, 2010).

There are many factors to be considered when managing patients with chronic venous disease. In the prevention and treatment phases, there is a reliance on the skills and knowledge of the individual practitioner to identify what is affecting both the development and healing of the venous ulcers. As described in this article, it may not be the application of the bandage system alone that is responsible for optimal or poor healing outcomes, but it may be related to the ability of the patient to tolerate the therapy.

It is essential that the clinician works in tandem with the patient to agree a management plan that takes into account the clinician's rationales and expectations, as well as the concerns of the patient. Venous leg ulcer management is, at times, an undervalued service yet if we get it right, the impact can be significant. **WE**

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