Compression therapy for venous leg ulceration: Part 3 – multilayer bandaging

Bandaging is an essential skill for the clinician engaged in venous leg ulcer management. Clinicians are responsible for ensuring they have the requisite skills in patient assessment, management, and bandaging to ensure the safety of the patient and to facilitate successful healing (Royal College of Nursing, 1998).

This article is the third in an ongoing series aimed at outlining the various means of achieving therapeutic compression therapy for the individual patient. The first installment examined the role of the padding layer in reshaping the limb and protection from pressure damage (Beldon, 2012a), while part 2 explored the role of inelastic, short-stretch bandages (Beldon, 2012b).

To provide the best possible care, the clinician must focus on the individual, as each person they encounter with venous disease or venous ulceration will present with different comorbidities, level of mobility, and lifestyle needs. Consequently, the clinician must develop the knowledge and skills to both assess the individual and apply different types of compression therapy, in order to individualise each patient's care, maintain a concordant relationship with the patient, and maximise the compliance of the patient.

The purpose of compression bandaging is to reverse the effects of venous hypertension and, by so doing, allow the venous ulcer to heal. This is achieved by decreasing the pressure within the superficial veins and aiding venous return, reducing oedema, and minimising or reversing skin changes (Vowden and Vowden, 2012).

For compression therapy bandaging to be effective, it must be graduated; the pressure should be greatest at the ankle and become progressively less at the calf. Therefore, an essential part of patient assessment must be accurate measurement of the ankle and calf before selecting suitable compression bandaging.

Multilayer compression bandaging may refer to any combination of bandaging used to achieve therapeutic compression (Hopkins, 2006), but is often called "four-layer bandaging", which has been in use for many years and was initially developed by a team working to improve wound care in the community in London (Moffatt et al, 1992).

Four-layer bandaging system

There are a number of four-layer bandaging kits available that provide the clinician with the appropriate bandages required and a basic nonadherent dressing. The total accumulative pressure applied should be 40 mmHg (Moffatt, 2005).

"Multilayer compression bandaging is often called 'four-layer bandaging' and was initially developed by a team working to improve wound care in the community."

PAULINE BELDON
Tissue Viability Nurse Consultant, Epsom and St Helier University Hospitals NHS Trust, Carshalton

Figure 1. ***(a) Application of the padding layer from toe to knee, overlapping the previous layer by 50%, to ensure all skin is protected. (b) Crepe bandage layer, applied in a spiral application. (c) Application of class 3a bandage. (d) Application of the class 3c bandage.***

Layer 1

The wool/padding bandage must be applied from the base of the toes to just below the knee. The purpose of the wool layer is to protect the skin from the pressure of the overlying bandages, absorb exudate, and provide a limb shape that ensures graduation of compression on application of the bandage (Beldon, 2012a). Examples include Profore 1™ (Smith & Nephew), K-Soft™ (Urgo Medical), and Ultrasoft™ (Robinson Healthcare).

The dorsum of the foot and the Achilles tendon must be well covered. If there has been reduction in calf muscle, an extra padding bandage should be added to ensure a 10 cm difference between ankle and calf to ensure graduation of compression (*Figure 1a*).

Layer 2

A crepe bandage is then applied to cover the padding layer, from toe to knee, which smooths the wool layer and adds absorbancy, but does not apply any compression (*Figure 1b*).

Layer 3

A class 3a bandage is applied next. Two anchoring turns at the base of the toes must be made. The clinician must ensure the foot and heel are covered before proceeding up the leg. The bandage should be stretched to 50% of its maximum elasticity, using either a spiral technique for reduced compression (two overlapping layers) or a figure of eight application for therapeutic compression (four overlapping layers). Between 14 mmHg–17 mmHg of pressure must be applied, depending on the method of application. Examples of 3a bandages include Elset™ (Mölnlycke), K-Plus™ (Urgo Medical), and Profore 3™ (Smith & Nephew; *Figure 1c*).

Layer 4

The class 3c bandage – the final compression bandage – should be applied with two anchoring turns at the base of the toes, before ensuring the foot and heel are completely enclosed. The clinician should then proceed up the leg using a 50% extension and ensuring a 50% overlap of bandage. Pressure exerted should be 20–25 mmHg, depending on the method of application and ankle circumference (*Figure 1d*).

Two-layer bandaging system

Multilayer bandaging may also refer to two-layer bandaging. This comprises two layers of bandaging and is suitable for patients with an ankle circumference >18 cm.

There is a difference in the application of pressure between two- and four-layer bandage kits, which emphasises the necessity for the clinician to familiarise themself with these contrasts. For example, the Coban Two-layer kit™ (3M™) has a soft padding layer, which is covered by a high-compression cohesive bandage that applies 40 mmHg of pressure at the ankle, whereas the K-Two kit™ (Urgo Medical) comprises a K-Tech™, padding layer, which is a short-stretch compressive fabric, covered by K-Press™ – a cohesive elastic bandage. When applied correctly, the kit achieves 40 mmHg of pressure at the ankle.

Two-layer bandaging is not as bulky as four-layer and, as such, have gained in popularity as the patient is more easily able to wear their usual shoes. Other examples of two-layer bandaging kits aside from K-Two™, include Proguide™ (Smith & Nephew) and Coban™ 2 Layer Compression system (3M™).

Factors influencing bandage choice

Ankle circumference

If the circumference of the ankle is narrow (i.e. ≤17cm), a multilayer compression bandage may provide

the safest application of therapeutic compression as the pressure is diffused throughout the bandage layers. The pressure achieved through bandaging is inversely proportional to the ankle circumference.

Prior to using multilayer bandaging, the clinician should recall aspects of the bandaging equation: pressure (exerted by the bandage) = tension (how much the bandage is stretched) × number of layers of the bandage / circumference (width of the ankle) × width (of the bandage).

This equation is especially important when using class 3a bandages (i.e. Profore 3, K-Plus, and Comprifore™ [BSN Medical]). When these bandages are applied in a spiral with a 50% overlap, they provide two layers, however, when applied in a figure of eight, they provide four layers, increasing the pressure applied at the ankle. If the ankle circumference is wide (25 cm–30 cm), then the pressure achieved will be <40 mmHg, necessitating adjustment in the four-layer bandaging technique or a switch to the two-layer bandage system.

Age

The older person may not be able to tolerate the application of 40 mmHg of pressure immediately. If this is a factor, the clinician should begin with a padding layer, crepe bandage, and then use a class 3a bandage, which will apply between 14 mmHg and 17 mmHg pressure at the ankle. While this might not deliver a therapeutic level of compression, it may be all the individual can initially tolerate and, in the interests of maintaining a concordant relationship, the clinician may need to adopt a pragmatic approach.

Case studies

Case 1

Figure 2 shows an 85-year-old man with a narrow ankle circumference of 17 cm, who had presented with a nonhealing venous ulcer. The patient had complained of pain on application of a two-layer bandaging kit, which applied 40 mmHg of pressure. The narrow ankle circumference caused the applied pressure to be much higher than 40 mmHg. Compression was reduced by using a class 3a bandage in a figure of eight application over the padding and crepe bandages. The patient found this more comfortable and they were able to comply with leg elevation and dorsiflexion exercises.

As the patient becomes more tolerant of compression, the amount of pressure applied can be gradually increased. It is wise to remember that some patients may never be able to tolerate therapeutic levels of compression and that compromise needs to be reached between the clinician and the patient.

Case 2

Figure 3 shows the venous leg ulcer of an 87-year-old woman who had self-treated her venous ulcer for several years. Before being referred to the community nursing team, she was referred to the tissue viability clinic as being "noncompliant" with care. It transpired that she did not understand why she needed compression therapy and felt the community nurses had not listened to her: "After all, it's my leg," she said. She removed the bandaging regularly, stating it was too tight.

The patient had all compression removed, with an agreement reached that for 1 week she would undertake regular rests with her legs elevated and complete dorsiflexion exercises. Following this, compression was introduced using a class 3a bandage in a spiral application. As the patient increased

Figure 2. Person with a venous ulcer and narrow ankle circumference (17 cm).

Figure 3. Person with a long-standing venous ulcer, which required gradual introduction of compression bandaging.

Figure 4. Person with a painful venous ulcer, who required analgesia education before being able to tolerate compression.

in tolerance, the pressure was increased by applying the same bandage in a figure of eight. A cohesive bandage was eventually applied to achieve four-layer bandaging and the patient then felt ready to comply. This resulted in slow, but sustained healing, evidenced by a gradual reduction in ulcer size. This episode highlights the importance of clinicians listening to their patients.

Case 3

A 70-year-old man was referred to the tissue viability service as being unable to tolerate compression and his community nurses felt he might have an underlying arterial problem (*Figure 4*). Following discussion with the patient, it was discovered that he suffered acute pain, which was not being effectively managed, primarily because he did not understand that analgesia should be taken regularly to be continuously effective. He only took his analgesia when he experienced pain and then found it ineffective.

Assessment of the patient revealed no underlying arterial problem. Regular analgesia and a temporary reduction in compression bandaging was sufficient to allow him to tolerate therapeutic compression using four-layer bandaging after 2 weeks.

Pain or discomfort experienced by the patient can influence compliance. It is crucial that the clinician assesses pain and discomfort, and listens carefully to the patient's description of when pain occurs and what means they take to alleviate the pain. Pain is not uncommon in venous leg ulcer patients (Newton, 2010) and may indicate an underlying arterial disease, and the clinician should regularly check the patient's arterial supply using Doppler ultrasound (Worboys, 2006). If pain is proving difficult to manage (perhaps due to an underlying comorbidity, i.e. arthritis in the ankle), then a multilayer compression bandage may be more easily tolerated by the patient than a two-layer bandage.

The patient may have strong views regarding the prospect of bandaging, perhaps influenced by a previous experience (Vowden and Vowden, 2012), and these should be heard and a compromise reached between patient and clinician. It may be necessary to change the type, or reduce the level, of compression. While this might result in a longer healing time, it is worthwhile if the patient remains engaged in their treatment and feels their opinions have been taken on board (Moffatt, 2004). The value of a concordant relationship should not be underestimated; clinicians and patients must work together for successful outcomes to be achieved.

Conclusion

Only a thorough assessment of the patient, including their comorbidities, mobility, lifestyle, and limbs, will enable the clinician to make a decision, together with the patient, on how best to proceed with the leg ulcer treatment. Involvement of the patient in their treatment aids healing outcomes. WE

References

Beldon P (2012a) Compression therapy for venous ulcers: padding layer. *Wound Essentials* 7(1): 10–8

Beldon P (2012b) Compression therapy for venous ulcers: Part 2 Inelastic, short stretch bandages. *Wound Essentials* 7(2): 28–32

Hopkins A (2006) How to apply effective multi-layer compression bandaging. *Wound Essentials* 1: 38–42

Moffatt CJ, Franks PJ, Oldroyd M, Bosenquet N (1992) Community clinics for leg ulcers and impact on wound healing. *BMJ* 305(6866): 1389–92

Moffatt CJ (2004) Factors that affect concordance with compression therapy. *J Wound Care* 13(7): 291–4

Moffatt CJ (2005) Four-layer bandaging from concept to practice, part 2: application of the four layer bandaging. *World Wide Wounds*. Available at: http://bit.ly/YFsf9H (accessed 08.05.2013)

Newton H (2010) Assessment of a venous leg ulcer. *Wounds Essentials* 5: 69–78

Royal College of Nursing (1998) *Clinical Practice Guidelines: The Management of Patients with Venous Leg Ulcers*. Royal College of Nursing Institute, London. Available at: http://bit.ly/Umsm84 (accessed 08.05.2013)

Vowden K, Vowden P (2012) How to guide: effective compression therapy. *Wound Essentials* 7(2): 1–6

Worboys F (2006) How to obtain the resting ABPI in leg ulcer management. *Wound Essentials* 1: 55–60