Successful management and treatment of venous leg ulcers is a high priority for all those working within wound care, as well as for the patients affected. Since its introduction in the early 1990s, four-layer bandaging (4LB) has been the ‘gold standard’ compression treatment for venous ulceration. However, many patients find the level of compression delivered by this system to be very uncomfortable or even painful, and as a consequence concordance (and healing rates) can be adversely affected.

Recent years have seen the introduction of an alternative system of compression bandaging, using cohesive short-stretch bandages (CSSB). Although the mode of action differs from 4LB, CSSB has been reported to be comparably effective as 4LB. The differing mode of action also means that some patients who cannot tolerate 4LB can tolerate CSSB.

At the heart of concordance is patient involvement and choice. Patients who participate in the decision about what treatment to use are more likely to follow through with that treatment. This suggests that in cases where two treatments are equally effective, patient choice should be the deciding factor in selection of one system over another.

So what evidence is there on the respective effectiveness of 4LB and CSSB in the treatment of leg ulcers? This article reviews the available trials, and examines the advantages and disadvantages of each system.

**Literature review**

A comprehensive literature search was undertaken. The CINAHL, BNI, Medline and Embase databases were searched using the terms leg ulcer, 4 or four layer bandaging, cohesive/short stretch bandaging, compliance and concordance. The criteria for review were that the studies should be large and robust. Three randomized controlled trials and one review of trials were identified.

**Cullum et al, 2001**

In 2001, Cullum et al published their findings about compression for venous leg ulcers as part of a systematic review for the Cochrane Collaboration. Their objective was to assess the effectiveness and cost-effectiveness of compression bandaging and hosiery. Twenty-two trials were reported and 24 comparisons were identified within these trials. Four out of six trials demonstrated that compression was more effective than no compression. Three trials found that there was no statistical significant difference in healing rates between 4LB and other high compression multi-layered systems. However five studies showed that elastic compression (4LB) was more effective than non-elastic compression.

However, Cullum et al concluded that:

‘Rather than advocate one particular system it would seem more sensible to promote the increased use of any correctly applied high compression therapy.’

(Cullum et al, 2001)

**Iglesias et al, 2004**

Iglesias et al (2004) reported their results from a multi-centred randomized controlled trial (RCT) conducted in England and Scotland. The aim was to compare the clinical and cost effectiveness of two different bandaging systems, 4LB and short stretch bandage (SSB). It also set out to test the hypothesis that SSB would be more cost-effective than 4LB. A total of 387 people were recruited to the trial between April 1999 and December 2000. Patients who had an ankle brachial pressure index (ABPI) <0.8, or diabetes, or a maximum ulcer <1cm, were excluded from the trial.
‘Patients with venous leg ulcers have extensive symptoms, related both to their venous insufficiency and to the wound itself. Symptoms such as pain, malodour, oedema and the amount of exudates often affect their psychological wellbeing.’

Eighty-two percent of patients had an ulcer area of <10cm (larger surface area ulcers were excluded to try and eliminate bias in any one of the study arms). The proportion of patients healed at 12 and 24 weeks were reported.

The results showed that there was no statistical significance in the proportion of ulcers healed at 12 weeks, but that at 24 weeks a slightly higher proportion of patients had healed in 4LB than SSB. Overall the actual totals of patient healed in the 4LB and SSB groups were 80.5% and 76.5% respectively, which was not statistically significant at the 5% level (95% CI 1 - 4 to 15%). On average, patients in the 4LB group healed 10.9 days before those in the SSB, but again this was not statistically significant.

While this is the largest and most current RCT in the UK to date in this subject, it was unable to provide any evidence on the use of cohesive SSB as this was not available in the UK at that time.

One major consideration for any research in this field has to be nurses’ knowledge and training in application of 4LB and SSB. Nurses may be more familiar with application of 4LB than SSB as traditionally SSB are used more in Europe (Williams, 2001). Key nurses involved in Iglesias et al’s study received a total of 80 minutes training time applying the trial bandages(no indications are given as to time spent on training for each bandage system). They then had to cascade this training to their colleagues. Therefore consideration must be given to the difference in learning curves that staff were embarking on at the time of the study. There were also three different methods of applying the SSB. These differences are not reported, nor how this may have affected the results.

Cost of treatment was found to be in favour of 4LB because between one and two extra nurse visits per month were required for patients in the SSB arm. The reason for this is not stated, but it could have been bandage slippage, as it is reported in the literature SSB can require more frequent application (Hampton, 1997).

Moffatt et al, 2003

A smaller scale, multi-centre RCT was conducted by Moffatt et al (2003). One hundred and nine patients were randomised to receive either 4LB or SSB. Over 24 weeks of treatment, 50 out of 57 (88%) patients randomized to 4LB and 40 out of 52 (77%) randomised to SSB experienced healing. Moffatt et al (2003) state that there is no difference in the rate of ulcer closure or the time to closure for patients managed with 4LB and SSB. Interestingly Moffatt et al (2003) report that cost of application of SSB over 24 weeks being slightly higher: £41 more per patient for the same expected clinical outcome.

Franks et al, 2004

In an RCT by Franks et al (2004a,b), the researchers set out to evaluate health related quality of life (HRQoL) of patients with venous leg ulceration – comparing 4LB and CSSB. Twelve centres took part in the study, with 72 and 82 patients receiving 4LB and CSSB respectively. Groups were well matched for age, gender, medical history and venous characteristics. The Nottingham Health Profile (NHP) was used to assess HRQoL at the start and end, withdrawal and/or healing, and at 24-week points within the trial.

Overall healing rates were good within the trial, with 71.2% of patients healing. There were similar healing rates between the two groups, 51/74 (68.9%) healed with 4LB compared with 62/82 (75.6%) with CSSB. Franks et al (2004a,b) report HRQoL issues were similar between the groups, but with a small non-significant improvement in patients randomized to CSSB. No comments were made on cost comparisons of the differing systems, neither how training was addressed to approach the trial. As with the other trials it would seem that providing effective treatment for patients is key, rather than adopting one particular bandage regimen.

Recommendations for future research

It would be useful to assess the cost implications of 4LB versus CSSB, as previously that comparison has not been reported. Within the two systems, bandage slippage is sometimes experienced when reducing oedema—particularly at first application. Could it therefore be more cost effective to use CSSB if it can remain in situ as long as its 4LB counterpart? Finally, in all studies reviewed patients were randomised to a treatment regimen, in a climate of informed choice, it would be interesting to study further which system patients themselves would choose.

Four-layer bandaging

This method of bandaging was developed at Charing Cross hospital in the early 1990s and since then has been accepted as the ‘gold standard’ in the treatment of venous leg ulcers (Moffatt, 2004a). The bandage works by applying a continuous level of sustained compression on the limb. 4LB forms an elastic cylinder around the leg. This expands and contracts with the calf muscle, which acts on the venous system by creating increased force in the leg, thereby reversing venous hypertension.

Advantages

• There is an abundance of literature and several RCTs to support its use and safety
• It is possible to gradually increase bandage pressures so that patients can adjust to the system
• Pressures are adjustable by the use of a combination of layers so the system is usable for mixed aetiology as well as venous ulcers
• Most community nurses and all leg ulcer specialist nurses know how to apply the system, so training is not an issue and supervision of new practitioners is readily accessible.

Disadvantages
• The system is bulky, meaning patients are restricted with their footwear and clothing
• It can be an expensive option when compared to other systems available
• Sub-bandage pressures can be too high or too low and achieving the correct tension is not an exact science, margins for error are potentially high risk
• The time spent on application of 4LB can put a lot of strain on the nurses’ backs, particularly in a community setting.

Short-stretch/cohesive short-stretch bandaging
SSB is the commonest form of treatment for venous ulceration on the continent (Ellis, 2004). However, it are now being used more readily in the UK. It works in a very different way to the four-layer system. It provides a tube-like structure on the limb, compressing the limb. Once the calf muscle is activated it rebounds against the bandage causing blood flow back to the heart. Therefore resting pressure is lower than working pressure (Hawkins, 2001).

Advantages
• Only two layers, so less bulky than four
• Can be more comfortable to wear at rest for the patient
• Quicker than 4LB to apply, so less risk of back injury or strain to nurse (Ellis, 2004)
• Same bandage is usable for all limb sizes
• In the case of CSSB, slippage is less of a problem
• Reduced risk of over-compression, as the bandage is applied at full stretch. Potential margins for error are lower than 4LB
• Has similar healing rates as 4LB
• Can be used on mixed aetiology wounds (Prytherch et al, 2003)
• Can be used on patients with limited mobility (Lindsay et al, 2003)
• More chance of patient concordance, as easier and more comfortable to wear
• SSB can be washed and reused (CSSB cannot)
• Is a cheaper system than 4LB even when bandages are not reused.

Disadvantages
• May need a new training programme to be put in place, as can be an unknown system to many nurses. However, the manufacturing companies will often assist.
• Further RCT studies would be advantageous
• Totally immobile patients are usually not suitable for this system.

Application of CSSB
A full holistic assessment of the patient and the wound has to be undertaken before any compression is applied. Nurses’ own local guidelines must be adhered to with regard to ABPI readings and the application of compression.

Ankle circumference <25cm
• For ankle circumference of less than 18cm: Increase ankle size to this or above using padding.
• For ankle circumference of 18–25 cm: Apply extra wool padding to boney or vulnerable areas, ie. shin bone and ankles

Apply wool padding from toe to knee in a spiral technique with 50% overlap, ensuring that the foot is at 90° to the leg. Secure padding with two turns initially at the toe, stopping one finger width below the knee

Apply compression from toe to knee, again with 90° flexion of the foot and 50% overlap as before. Secure the bandage at base of toes with 2 turns around the foot. Do not apply full compression to the foot. Once at ankle enclosure it with a figure eight. Roll bandage onto leg at full stretch all the way to 2 finger widths below the knee and cut off excess bandage.

Ankle circumference >25cm
Apply as above, but apply a second compression bandage in opposite direction to the first, starting at ankle this time.

In order for any bandaging system to work, the patient’s leg needs to be padded out to make it a ‘normal’ leg shape and this should be done using the padding layer (Moffatt, 2004b).

Cost
There are always many dimensions to health-care economics. On a basic level, the cost of CSSB and padding for an ankle circumference from 18–25cm is between £3.16 and £3.28 cheaper than 4LB for the same size ankle, depending on the 4LB brand used (prices at time of writing and available on FP10). CSSB is designed to be left in place for one week, the same as their 4LB counterparts. Bandage slippage can occur with both systems in the initial stages of treatment as oedema reduces. The research reviewed reported that SSB needed to be reapplied slightly more frequently. However, reapplication of CSSB could possibly be reduced in line with four-layer systems, although currently research is not available on this.

Good practice would dictate that at the start of any new treatment close supervision is necessary and therefore cost and frequency of nurse visits is an unpredictable variant that cannot always be accounted for.

Concordance
Concordance is an important issue that affects successful leg ulcer management. The Department of Health (2001), defines concordance as:

‘A partnership between patient and health professional in which an agreement is reached about
Patients with venous leg ulcers have extensive symptoms, related both to their venous insufficiency and to the wound itself. Symptoms such as pain, malodour, oedema and the amount of exudates often affect their psychological wellbeing. They may feel hopeless, helpless, angry, depressed, lacking control and frustrated. Leg ulcers can adversely impact on lifestyle and, for some, severely impair mobility. This may prevent people from leaving their home, which may result in social isolation and altered body image. These are just some of the considerations to make about patients care when helping them cope with treatment regimens.

Charles (1995) reported that health-care professionals are often unwilling to listen to and accept patients’ accounts of their condition. They also underestimate the significance of pain and ill effects of treatments. Lindsay (2001) postulated that patients would be more likely to comply with treatment if they had some control over the situation and were partners with the nurses in the decision-making process. It is therefore essential that time is spent with patients explaining and negotiating what will happen so that they can be part of this process (Bourne, 2004). Using a partnership approach should help improve concordance issues.

The NHS Improvement Plan (DH, 2004) places great emphasis on:

- Putting patients and service users first by providing more personalized care
- Taking a holistic approach to patients’ health and well-being, not simply focusing on illness
- Devolving decision-making to local organizations.

To achieve these targets in leg ulcer management we need to challenge traditional ways of working and recognize both service and nurses’ limitations (Dowsett, 2005).

Compression therapy is well established as being the preferred method of treatment for venous ulcers (Cullum et al, 2001) and there is a consensus that, although not ideal, any level of compression is better than none. Continuous effort is required to convince patients of its importance (Dereure et al, 2005) or explore different types of compression to find a method that is more suitable for the individual. It is therefore necessary that nurses are skilled appropriately to deliver a choice of compression bandaging to their patients.

Conclusion

Chronic ulceration of the leg can be a painful and socially isolating condition to suffer and incurs considerable expense to the NHS. Skilled assessment and treatment is necessary so that they are better equipped with the knowledge to provide patients with choices. This article has examined the available research on compression bandaging and explained more about the benefits and disadvantages of two differing compression systems. Nurses can influence selection of compression bandages and can help to empower their patients with informed patient choice and knowledge of different compression systems.

KEY POINTS

- In the management of venous leg ulceration any compression is better than none (Cullam et al 2001)
- Patients should be offered a choice of compression bandages, to improve better concordance rates
- Healing rates of patients treated with CSSB are comparable with 4LB systems (Franks et al 2004)
- CSSB is safe to use and simple to apply

Dowsett C (2004) Patient involvement must be a key aspect of choosing an appropriate regimen for leg ulcer management. J Wound Care 13(10): 443–4