



An educational supplement in association with



A proven alternative to compression bandaging

Clinical review of juxtacures

Effects on patient adherence, quality of life and healing outcomes



April 2017

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In today's stretched NHS, it is crucial that health-care providers and clinicians maximise resources and efficiency without compromising patient outcomes. Following its introduction in the late 1970s, four-layer compression bandaging was classed as the gold standard compression therapy and became the traditional first-line choice for the treatment of venous leg ulcers (VLUs). Since then, compression therapy bandaging has evolved with the introduction of two-layer compression bandage systems and wrap systems.

Managing VLUs can take up considerable nursing time and resources: Chamanga (2014) found that community nurses might see six to seven patients with bilateral VLUs per day, while high levels of education and training are required to apply compression bandaging correctly.¹ Chamanga also reported that, in many areas, nurses' skills and knowledge about compression therapy vary greatly, particularly in places with large numbers of bank and agency staff due to high staff turnover.¹ This problem is exacerbated by the inconsistent provision of educational information and training on application. In addition, as consultations are now often shorter in the UK, there is less time to discuss with patients issues affecting their health needs, lifestyle, choices and concordance, and to educate them on the benefits of compression therapy.

Many patients find compression bandages uncomfortable, while their bulkiness can reduce their choice of clothing, footwear and even result in reduced mobility. This can adversely affect adherence with treatment and healing rates.² Adherence can also be reduced if patients have difficulty attending appointments for the application of compression therapy due to work commitments and other time constraints.

Following the introduction in the past 3 years of Velcro wrap compression systems, there is now an alternative to bandaging for the treatment of VLUs and the management of limb oedema. Juxtacures is one such system. It can also improve patient comfort, quality of life and aid adherence without compromising outcomes. It can be used as a first-line treatment and can overcome many of the problems associated with compression bandaging systems.

Juxtacures has benefits not just for patients and clinicians, but also for stretched NHS finances. Its ease of use and the simplicity and speed with which staff, carers and patients can be trained on its application can reduce the frequency and duration of nurse visits in the community and improve healing outcomes. Patients have greater choice in terms of selection, while the garment can help them to self-care, which will promote independence and improve quality of life. Therefore, juxtacures compression therapy not only empowers, but is also both efficient and effective.

In summary, the overall benefits of juxtacures for clinicians are:

- Ease of training and application, which can be undertaken by both qualified and non-qualified staff, thereby increasing the skill mix within teams
- Less clinical time is spent on application
- Its ease of use will empower patients to self-care, thus reducing the number of clinic/community nursing appointments
- Clinicians have increased confidence, due to the built-in pressure system (BPS) card, that the correct compression pressure will be consistently applied
- It provides a cost-effective treatment regimen for the health-care provider.

Benefits for the patient are:

- Increased independence and ability to self-care
- Reduction in the amount of time spent attending appointments or waiting for community nursing visits
- The garment's improved aesthetic appearance gives them the opportunity to wear their own choice of clothes and footwear, which will increase adherence with compression therapy
- Improved outcomes, both in terms of prevention and healing, will enhance quality of life, self-esteem and confidence.

References

- 1 Chamanga, E., Christie, J., McKeown, E. Community nurses' experiences of treating patients with leg ulcers. *J Community Nurs* 2014; 28: 6, 27–34.
- 2 O'Meara, S., Cullum, N., Nelson, E.A., Dumville, J.C. Compression for venous leg ulcers. *Cochrane Database Syst Rev* 2012; 11: CD000265. doi: 10.1002/14651858.CD000265.pub3.



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Factors affecting adherence and efficacy of compression bandaging

With prompt diagnosis and treatment, simple venous leg ulcers are expected to heal in 12 weeks. Yet the literature indicates the incidences of non-healing and recurrence are high. This article explains how these problems can be addressed

A study by Guest et al.¹ indicated that approximately 1.5% of the UK population has an active leg ulcer, with venous leg ulcers (VLUs) being the most prevalent. Simple VLUs should heal within 12 weeks if treated appropriately. More complex VLUs can take up to 24 weeks to heal.² A review of VLU healing rates by Guest et al.³ indicated that as few as 6–9% of patients with VLUs healed within 26 weeks. Low healing rates can be attributed to lack of clinical assessment and poor adherence to guidelines on best practice, which consider compression therapy as essential to facilitate healing and prevent recurrence.^{2,4–6} Patient non-adherence with treatment is another key factor. This article explains why these problems occur and how they can be best avoided.

Causes and manifestations

The National Institute for Health and Care Excellence (NICE) has defined a VLU 'as the loss of skin between the knee and ankle joint that occurs in the presence of venous disease, which takes more than 2 weeks to heal'.⁷ This is attributed to incompetence in the valves in the venous system and calf muscle insufficiency.⁸ The valves within the venous system normally

prevent backflow of blood, and the calf muscle assists venous return via its pump mechanism (Fig 1).⁹ Damage to the valves allows backflow of blood down the vein towards the ankle (Fig 1). Venous reflux and venous obstruction increases venous hydrostatic pressure, which results in venous hypertension.¹⁰ Chronic venous hypertension can lead to oedema and skin changes such as haemosiderin staining, atrophie blanche, ankle flare and lipodermatosclerosis, which can eventually result in ulceration.⁴

A full holistic assessment will facilitate diagnosis and help the clinician determine what is the most appropriate treatment for the patient.^{4,6,11} Its components are listed in Box 1.

Role of compression therapy

Following assessment, the aetiology of the leg ulcer can be determined and treatment options considered. For VLUs, the aim is to assist venous return via the application of graduated compression therapy, combined with rest, leg elevation and foot exercises. Compression therapy is a non-invasive treatment that works by applying an external pressure to the limb,⁵ which reduces venous hypertension and oedema, and thus improves lymphatic drainage.

Box 1. Components of a holistic assessment

- Patient assessment: comorbidities, past medical history, medication, nutrition, allergies, obesity, and psychological and social influences
- Limb assessment: oedema, skin condition, clinical signs of venous or arterial disease, limb size and shape, range of ankle movement, ankle brachial pressure index (ABPI) measurements
- Wound assessment: the wound location, wound measurements and characteristics, and exudate and pain levels
- Lifestyle assessment: whether or not the patient is self-caring; the skill of the person who is administering ongoing care
- Lifestyle choices: includes smoking, drug and alcohol abuse, obesity and exercise

The most effective level of compression is 40 mmHg at the ankle.¹²

A patient's ankle brachial pressure index (ABPI) calculation is used to assess for evidence of arterial disease and will help the clinician identify the level of arterial disease present. It will not diagnose the ulcer, however. An ABPI of 0.8–1.3 is considered safe for the application of compression. An ABPI of less than 0.8 is indicative of a mixed aetiology ulcer, where a patient has reduced arterial flow or arterial disease. The lower the ABPI

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reading, the lower the level of arterial blood flow. Mixed-aetiology ulcers can have clinical signs and symptoms of both venous and arterial disease.⁵ Reduced or lower levels of compression can be advised for patients with mixed-aetiology ulcers, but this must be based on a full holistic assessment, during which specialist advice might need to be sought. Compression is contraindicated for patients with mixed-aetiology ulcers whose ABPI is below 0.5.⁹ Its use is inadvisable in cases of uncontrolled cardiac failure and diabetic foot ischaemia.² The ABPI should always be considered within the context of a holistic clinical assessment, as there are instances when an ABPI reading can be unreliable, such as when vessels are calcified in patients with diabetes and small vessel disease, which can result in an abnormally high calculation.⁴ It is also important to consider the sounds of the pulses (i.e. triphasic, biphasic and monophasic), as this gives a greater indication of the presence and extent of any arterial disease.

Compression therapy improves ulcer healing rates and may improve patients' quality of life.⁵ A Cochrane review of randomised control trials (RCTs) on VLU concluded that healing rates are significantly increased in patients given compression compared with no compression.¹² While systems offering high compression (>40 mmHg) should be considered as a first-line treatment, this is not always possible in clinical practice. In such cases, lower levels of compression (<20mmHg) are better than no compression.⁵

Harding et al.² have suggested that the ideal compression system would have the properties outlined in Box 2.

Several different types of compression system are available, including compression bandages (elastic or inelastic), adjustable Velcro compression wraps, intermittent pneumatic compression and hosiery. Each system has its advantages and disadvantages. Selection will be influenced by the following factors:^{2,6}

- Volume of exudate
- Wound progression
- Shape and size of the limb
- Patient's pain levels and mobility
- Expertise of the person applying the system
- Patient choice

Box 2. Properties of an ideal compression system²

- Delivers therapeutic compression and has high stiffness (pressure is effective during mobilisation and well tolerated during rest)
- Good anatomical fit
- Stays in place without slippage
- Is comfortable for the patient
- Allow patients to wear their own shoes and to maintain gait
- Is easy to apply and remove
- Requires minimal training on fitting and application
- Non-allergenic
- Aesthetically acceptable
- Cost-effective
- Offers patient choice

- The patient's ability to apply the compression, especially if she or he is self-caring
- Availability of the system on the local formulary
- Cost.

Compression bandages

The pressure (sub-bandage) applied by a bandage system is determined by many variables, including: the properties (elastic or inelastic) of the bandage, the number of layers applied, the width of the bandage and radius of the limb. This is based on Laplace's law.⁹ The technique and skill of the clinician applying the bandage will also influence the amount of pressure applied. Based on the principles of

Laplace's law, given that most limbs are wider at the calf than the ankle and assuming a bandage is applied with the same tension and overlap, the pressure at the ankle will be higher than that over the calf.¹⁰ This provides graduated compression, which improves venous return.⁹

Bandage systems can be described as either elastic or inelastic.

Inelastic materials (or short-stretch) bandages have few or no elastic fibres and are applied at full tension (100% stretch), creating high pressure peaks during movement and low pressures during rest; this is known as high static stiffness.⁹ This has been found to be highly effective in increasing venous blood flow and venous return, thereby reducing oedema.^{13,14}

Elastic materials consist of elastomeric fibres, which can stretch more than 100% of their original length.⁶ They have a low static stiffness as they apply a more constant pressure during both rest and movement.⁹ They are generally applied at 50% stretch.

The individual components of the traditional four-layer bandage (multilayer) are:

- Layer 1: provides padding, protects bony prominences and shapes the limb
- Layer 2: an elastic light support bandage
- Layer 3: an elastic extensible bandage, which gives a sub-bandage pressure of approximately 17 mmHg
- Layer 4: a cohesive bandage, which has a sub-bandage pressure of up to 25 mmHg, depending on the ankle circumference.¹⁵

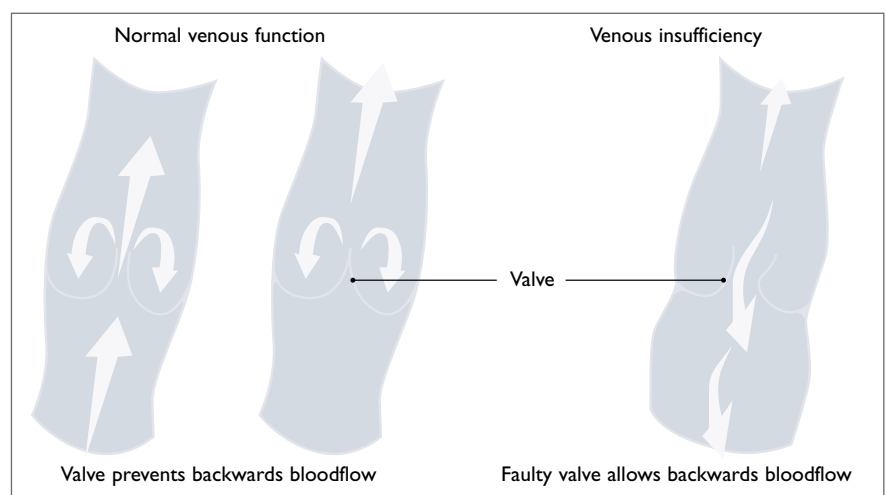


Figure 1. The calf muscle pump: normal and impaired function



Figure 2. How to apply juxtacures. **a)** Select the correct length: short, standard or long. **b)** After measuring the ankle and calf circumferences, juxtacures is assembled for a perfect fit. **c)** The excess material is cut away. **d)** The device is fitted to the lower leg. **e)** The pressure applied is checked with the built-in pressure system (BPS) card and adjusted as required

The final application of the system creates a less elastic effect, in that the build-up of the layers and the cohesive nature of the fourth layer restrict the movement of the bandages, allowing it to have a high static stiffness.¹⁶

Multicomponent two-layer bandage systems (elastic and inelastic) have the advantage of achieving a high static stiffness without the bulkiness associated with multilayer bandages, which can reduce ankle movements and make it difficult to find footwear that fits,¹⁷ potentially leading to non-adherence with treatment.

Multicomponent compression systems can achieve better patient outcomes than low stiffness systems in terms of oedema reduction, comfort and healing rates.¹²

Inelastic bandage systems with higher static stiffness may require more frequent application if there is a rapid reduction in oedema, which can cause bandage slippage. Most compression bandages do

not facilitate self-care, as the patient is reliant on the clinician to apply the treatment, which often involves clinic appointments or waiting at home for community service visits. Patients can be reluctant to wear compression bandages for aesthetic or practical reasons, such as work commitments and hobbies.

Issues affecting patient adherence

To achieve good outcomes in leg ulcer management, it is paramount that the patient is engaged in clinical decision-making and care. Education is therefore a key consideration. If patients understand why compression is required and are involved in the decision-making process, they are more likely to be adherent with treatment.¹⁸ To overcome language barriers, written resources should be available in different languages, and use of an interpreter considered when necessary. Chamanga

indicates that poor bandaging technique and lack of knowledge by clinicians can have a devastating impact on patients' quality of life.¹⁹

Also essential is collaboration between clinician and patient. This can be achieved by establishing a good rapport with the patient and showing empathy and understanding, especially if they are experiencing VLU-related issues such as pain, social isolation and financial constraints. The patient's expectations should be considered, as they might want to aim for different outcomes than the clinician, depending on the quality-of-life issues being experienced.¹⁹

Finally, the need for patient choice must be respected. This involves finding a compression system that is acceptable to the patient, promotes independence, where possible, and maintains mobility. This will, in turn, promote calf muscle function and thus optimise treatment.⁴

Training issues in bandage application

Clinicians who apply bandage systems need to understand the properties of the different systems available and how to apply them. In areas with a high staff turnover, it can be difficult to ensure that sufficient staff have competencies in compression bandaging. Failure to do this can result in variations in application technique and the amount of pressure applied, which will impair outcomes.² Providing training on bandaging techniques is often challenging due to lack of resources, excessive workloads and poor organisational support.⁵

Alternative options for compression therapy can be considered to reduce some of these training difficulties. These options are outlined below.

Hosiery

While hosiery is available in varying strengths, 40mmHg hosiery kits are recommended as a first-line treatment for preventing and treating venous ulceration.¹⁷ A RCT, involving 457 patients with VLUs, that compared the perceived gold standard (four-layer bandaging) with a two-layer hosiery kit found no difference in healing rates between them.¹⁷ Surprisingly, 39% of patients in the hosiery group changed treatments during the trial because of an increase in ulcer size, a deterioration in the

ulcer, discomfort and non-adherence with treatment. This suggests that, while the hosiery kit was more cost-effective overall, it might not be suitable for all patients, including those with unusual limb shapes or heavily exuding wounds. In addition, some patients find applying and removing hosiery kits challenging.²⁰ Nevertheless, these kits are useful for patients wishing to self-care as, generally, they can be used with existing footwear and do not require high levels of skill to apply.

Velcro wraps

An alternative option to compression bandages and hosiery kits is Velcro wrap garments. These are rigid in nature and use similar principles to inelastic compression bandaging in that they are high stiffness systems (low resting pressure and a high working pressure). Adjustable inelastic Velcro garments have been shown to be more effective than inelastic bandages^{21,22} in aiding venous return and reducing oedema. They are available in various formats and materials, with different mechanisms of application, pressure profiles and adjunctive garments for the foot and thigh.

Juxtacures

Juxtacures is a CE-marked adjustable system designed for use on the lower limb of patients with VLUs. Available on the UK Drug Tariff, it is intended for use over a primary dressing and is guaranteed for 6 months of daily use. The garment is machine-washable and can be tumble dried on a low setting. It comprises: a pair of soft comfort liners; a pair of comfort compression anklets; a breathable, flexible and adaptable wrap-around garment that includes a 'body', 'spine' and three Velcro-lined straps attached on each side; a disposable tape; and a unique built-in pressure system (BPS), which is a calibrated card that shows the mmHg applied (Fig 2). The garment is available in three lengths: short (28 cm), standard (33 cm) and long (38 cm). To determine the correct length, the leg is measured from the popliteal fossa to the ankle following the limb contour. Adaptability is provided by the 'body' and 'spine', which can be adjusted to fit ankle and calf circumferences of up to 42 cm and 64 cm respectively. The initial assessment and fitting should be

undertaken by a trained clinician using the manufacturer's instructions.

The garment's components combine to deliver a bespoke therapy system, as the clinician or patient can use the BPS card to measure the exact amount of graduated compression being applied. Depending on the individual patient's need and tolerance, a specific sub-bandage pressure of between 20 and 50 mmHg can be applied at the ankle. Under close specialist and/or medical supervision, the garment can be used to provide reduced compression on mixed-aetiology leg ulcers. It is this ability to measure the exact amount of graduated compression being applied that differentiates the garment from other Velcro systems. Use of the BPS card also ensures that the prescribed level of compression is maintained over time.²³ Therefore, juxtacures has all of the attributes of an ideal compression therapy system outlined above by Harding et al.² (Box 2).

Juxtacures should be applied as follows:

- Apply the leg liner over the wound dressing
- Apply the garment loosely into the correct position over the ankle and below the knee crease, ensuring that the 'spine' fits the contours of the leg
- Secure the garment with the Velcro straps so that they sit in juxtaposition with each other
- Once in the correct position, adjust the straps to obtain the correct pressure. Use the BPS card to measure the level of compression being applied at set marks up on the device
- The straps can be either tightened or loosened to achieve the prescribed pressure
- Apply the comfort compression anklet to control ankle and/or foot oedema as required.

The patient can easily adjust the Velcro straps during the day to ensure the correct pressure is maintained.^{21,22} When the oedema starts to reduce, the clinician should re-measure the ankle and calf circumferences and adjust the 'spine'. This ensures an appropriate level of compression continues to be applied. Step-by-step directions on application are included in the manufacturer's instructions for use. The system can be easily applied by both clinicians and patients. Patients can adjust the level of compression to what they find

tolerable and comfortable, which will encourage self-care and promote self-autonomy. Skin-care regimens can be maintained around the dressing and the garment removed for bathing. Normal footwear can be worn with the garment, and ankle movement is not restricted. Patients can perform day-to-day activities such as driving and walking, due to the unrestrictive nature of the garment, which is worn from the ankle to the knee. Indications, contraindications, cautions and precautions for juxtacures are given in Table 1.

One practical advantage is that the device can be machine washed should exudate strikethrough occur.

NICE Medtech innovation briefing

NICE produces Medtech innovation briefings (MIBs), which provide clinicians, managers and commissioners with evidence and information on the use of new medical devices and diagnostic technologies. The briefings include a description of the technology, how it is used and a possible treatment pathway.

In 2015, a briefing was published on the use of juxtacures adjustable compression system in the treatment of VLUs.²⁴ It describes its use as an alternative to standard compression therapy (bandages and hosiery) on mobile and immobile patients with VLUs. It states that patients who are unable or unwilling to wear traditional compression systems might find the garment useful, as it can be easily applied without specialist training after an initial assessment. This is pertinent given the challenges associated with compression bandaging, such as the need for specialist training, competency and consistent application over time, and the difficulties patients face in applying compression hosiery. Other benefits cited in third-party evaluations and case reports in the briefing include:

- Juxtacures can be used within existing VLU patient pathways
- The prescribed level of compression can be maintained over time
- Compression therapy can be initiated earlier in the treatment pathway as more nurses can be trained in its application
- It is quicker to apply than compression bandages

Table 1. Indications, contraindications, cautions and precautions for juxtacures

Indications	Venous insufficiency; venous leg ulcers; post-thrombotic syndrome; dependent oedema
Contraindications	Severe peripheral arterial disease; decompensated congestive heart disease; septic phlebitis; active thrombosis in the leg; decreased or absent sensation in the leg; allergy to the components/materials; moderate peripheral vascular disease
Cautions	Presence of infection/cellulitis of the leg (when reduced compression could be considered and adjusted to a level that can be tolerated by the patient)
Precautions	All Velcro straps should be secured to prevent the risk of falls

- Practice nurses will have more time to provide compression therapy
- Clinician input is reduced
- It enables patients and carers to be more involved in care, potentially improving concordance and thus patient outcomes.

The evidence on juxtacures included in the briefing comes from nine evaluations and case reports. Details about their objectives/hypotheses, study designs, settings, inclusion/exclusion criteria, primary outcomes, statistical methods, participants and treatments, results and conclusions are summarised in tables. The evidence comprises four published case studies,^{25–28} four case-study poster presentations^{29–32} and one case study abstract.³³ None of the evaluations was comparative, so it is unclear if other compression systems would have achieved similar results. All reported that the system improved healing and quality of life, and reduced wound size. None raised any safety concerns. Three of the evaluations calculated the cost savings achieved following use of the Velcro wrap.^{25,28,30} Although juxtacures is initially more expensive than traditional compression bandages and hosiery, it was found to be cost-effective when used over a 3–6 month period. This is because the same garment can be used over several months, whereas with bandages multiple purchases are required. A reduction in both nursing time and use of dressings/bandages helped reduce clinical waste, which also contributed to the savings.

The briefing outlined the limitations of the evidence: all of the evaluations had small sample sizes, patient selection was not clearly described, which could raise

concerns about bias, and five of the evaluations were not peer reviewed.

Despite this, the briefing noted that juxtacures has potential as an alternative to traditional compression bandaging with all its inherent challenges.

An in-depth description of the evidence on juxtacures is given in this supplement (pages S9–S18). This includes that published after the NICE briefing was produced.

References

- 1 Guest, J., Ayoub, N., McIlraith, T. et al. Health economic burden that wounds impose on the National Health Service in the UK. *BMJ Open* 2015; 5:e009283. doi:10.1136/bmjopen-2015-009283 (accessed 31/11/2017)
- 2 Harding, K., Dowsett, C., Flax, L. et al. Simplifying venous leg ulcer management: consensus recommendations. *Wounds International*, 2015. <https://tinyurl.com/jrxrcrj> (accessed 26 February 2017).
- 3 Guest, J.F., Taylor, R.R., Vowden, K., Vowden, P. Relative cost-effectiveness of a skin protectant in managing venous leg ulcers in the UK. *J Wound Care* 2012; 21: 8, 389–8.
- 4 Scottish Intercollegiate Guidelines Network (SIGN). Management of chronic venous leg ulcers. A national clinical guideline 120. SIGN, 2010. <https://tinyurl.com/3mc28s8> (accessed 26 February 2017).
- 5 Franks, P., Barker, J., Collier, M. et al. Management of patients with venous leg ulcers: challenges and current best practice. *J Wound Care* 2016; 25: 6 (Suppl), 1–67. <http://ewma.org/?id=219> (accessed 26 February 2017).
- 6 Wounds UK. Best Practice Statement. Holistic Management of Venous Leg Ulceration. *Wounds UK*, 2016. <https://tinyurl.com/jgevnzu> (accessed 26 February 2017).
- 7 National Institute for Health and Care Excellence (NICE). Clinical knowledge summaries. Leg ulcer – venous. NICE, 2016. <https://tinyurl.com/hl6xkad> (accessed 26 February 2017).
- 8 Ågren, M.S., Gottrup, F. Causation of venous ulceration. In: Morrison, M.J., Moffatt C.J., Franks, P.J. (eds). *Leg ulcers. A problem-based learning approach*. Mosby, 2007, p141–54.
- 9 Partsch, H., Mortimer, P. Compression for leg wounds. *Br J Dermatol* 2015; 173: 359–69.
- 10 Moffatt, C.J., Partsch, H., Clark, M. Compression therapy in leg ulcer management. In: Morrison, M.J., Moffatt, C.J., Franks, P.J. (eds) *Leg Ulcers: A Problem-based Learning Approach*. Mosby, 2007, 169–95.
- 11 Morison, M., Moffatt, C., Franks, P. *Leg Ulcers: A Problem-solving Approach*. Mosby Elsevier, 2007.
- 12 O'Meara, S., Cullum, N., Nelson, E.A., Dumville, J.C. Compression for venous leg ulcers. *Cochrane Database Syst Rev* 2012; 1: CD000265.
- 13 Mosti, G., Mattaliano, V., Partsch, H. Inelastic compression increases venous ejection fraction more than elastic

bandages in patients with superficial venous reflux. *Phlebology* 2008; 23: 6, 287–94.

- 14 Mosti, G. Relevance of stiffness of compression material on venous hemodynamics and edema. *Veins and Lymphatics* 2013; 1:e9 26–9. <https://tinyurl.com/jlnpvn9> (accessed 26 February 2017).
- 15 Moffatt, C. Four-layer bandaging: from concept to practice Part 2: Application of the four-layer system. *World Wide Wounds*, 2005 <https://tinyurl.com/fojod7j> (accessed 9 February 2017).
- 16 Charles, H. The function and composition of next generation bandages. In: *Wounds UK. Leg ulcer supplement*, 2012. <https://tinyurl.com/gn7jqsx> (accessed 26 February 2017).
- 17 Ashby, R.L., Gabe, R., Ali, S. et al. VenUS IV (Venous leg Ulcer Study IV) — compression hosiery compared with compression bandaging in the treatment of venous leg ulcers: a randomised controlled trial, mixed-treatment comparison and decision-analytic model. *Health Technol Assess* 2014; 18: 57, v-vi. doi: 10.3310/hta18570.
- 18 Moffatt, C.J. Perspectives on concordance in leg ulcer care. *J Wound Care* 2004; 13: 6, 243–8.
- 19 Chamanga, E.T. Understanding the impact of leg ulcer bandaging on a patient's quality of life. *J Community Nursing* 2014; 28: 1, 40–7.
- 20 Lim, C.S., Davies, A.H. Graduated compression stockings. *CMAJ* 2014; 186: 10, E391–8. doi: 10.1503/cmaj.131281.
- 21 Damstra, R.J., Partsch, H. Prospective, randomized, controlled trial comparing the effectiveness of adjustable compression Velcro wraps versus inelastic multicomponent compression bandages in the initial treatment of leg lymphedema. *J Vasc Surg Venous Lymphat Disord* 2013; 1: 1, 13–9. doi: 10.1016/j.jvs.2012.05.001.
- 22 Mosti, G., Cavezzi, A., Partsch, H. et al. Adjustable Velcro compression devices are more effective than inelastic bandages in reducing venous edema in the initial treatment phase: a randomized controlled trial. *Eur J Vasc Endovasc Surg* 2015; 50: 3, 368–74.
- 23 Kline, C.N., Macias, B.R., Kraus, E. et al. Inelastic compression legging produces gradient compression and significantly higher skin surface pressures compared with an elastic compression stocking. *Vascular* 2008; 16: 1, 25–30.
- 24 National Institute for Health and Care Excellence. The Juxtacures adjustable compression system for treating venous leg ulcers. NICE, 2015. <https://tinyurl.com/zqmjlev> (accessed 26 February 2017).
- 25 Bianchi, J., Mahoney, K., Nugent, L., Keen, D. A fresh way to treat venous leg ulcers with measured compression. *Br J Community Nurs* 2013; Suppl. 34: S36–40.
- 26 Dowsett, C., Elson, D. Meeting the challenges of delivering leg ulcer services. *Wounds UK* 2013; 9: 1, 90–5.
- 27 Lawrence, G. Juxtacures: an innovative method of providing compression for leg ulcer management. *Wounds UK* 2014; 10: 1, 64–70. <https://tinyurl.com/hz2fdac> (accessed 26 February 2017).
- 28 Nugent, L. Juxtacures: compression for healing venous leg ulcers. *Br J Community Nurs* 2013; 18 (Suppl. 9): S40–45.
- 29 Davies, L. A novel compression device: improving patient quality of life. Poster presentation at Wounds UK, 2013, Harrogate, UK. <https://tinyurl.com/gnk6jt6> (accessed 26 February 2017).
- 30 Elson, D. The 21st century approach for cost effective healing of venous leg ulcers. Poster presented at the Wounds UK Conference, November 2012, Harrogate, UK. <https://tinyurl.com/h7zb7p2> (accessed 26 February 2017)
- 31 Harris, H. Using an innovative compression system to improve patient concordance and quality of life whilst achieving clinical and financial outcomes. Poster presented at the Wounds UK conference: November 2013, Harrogate, UK.
- 32 Oates, L., Ranton, A., Roberts, D. Improving patient and nurse experience: a simple measurable graduated compression device. Poster presented at Wounds UK Conference, November 2013, Harrogate, UK. <https://tinyurl.com/hwd4dog> (accessed 26 February 2017).
- 33 Lurie, F., Kistner, R.L., Kennerknecht, T. Juxtacures deemed as a favourable treatment solution for venous ulcers. *Wound Care Therapies* 2012; 1: 1, 1.

Juxtacures: the clinical evidence

The clinical evidence on juxtacures comprises evaluations, case studies and poster presentations. A common theme that emerges is that the garment promotes self-care and adherence with treatment, which in turn help facilitate healing. The data also show that it is cost-effective over time

This chapter summarises the existing evidence on the use of juxtacures.

All of the available evidence, from published evaluations to conference poster presentations, is included. The aim is to inform clinical decision-making about the selection and use of this type of compression therapy. It should be noted that the descriptions of the evidence reflect the level of detail provided in the source material, and so may exclude information such as healing times if these were not reported.

The summary of this evidence initially focuses on efficacy in terms of healing outcomes and adherence with treatment, and then considers quality of life and wellbeing, and concludes with cost-effectiveness.

Efficacy: evaluations

Wicks undertook a pilot study in Wiltshire investigating the outcomes in 16 patients with VLUs who switched from compression bandaging to juxtacures.¹ The mean ulcer duration was 23 months and 1 week; the range was not given, but four ulcers had been present for more than 5 years. At the start of the pilot, several wounds (number not specified) required superabsorbent dressings. While the report does not specify how many patients healed nor give reduction in wound sizes, it does state that signs of healing were observed within 4 days in previously recalcitrant wounds treated with compression bandages. At 4 weeks, outcomes indicative of a progression to healing included a reduction in exudate levels and the need for superabsorbents, and wet legs becoming drier with an

associated reduction in malodour. Similarly, the full range of flexion and extension of the ankle facilitated by the garment promoted calf muscle function.

Following the success of the pilot, juxtacures was considered for all patients with VLUs.² A conversion programme was undertaken, involving 56 community patients, all of whom had been wearing compression bandaging before the switch to juxtacures. No additional inclusion criteria were specified.

After 6 months, the healing rate (defined as the percentage of patients on the caseload with a healed VLU) increased from a baseline of 19% to 39%, while the mean healing time reduced from 22 to 18 weeks. Fourteen patients (25%) healed within 6 months; all had chronic VLUs of at least 12 months' duration at inclusion.²

In an abstract, Lurie et al.³ described a retrospective case series involving 10 non-consecutive patients, eight of whom wore juxtacures all day every day and two wore it continuously for one week and then for 12 hours per day thereafter. Two patients withdrew from the evaluation for unrelated reasons. The ulcers in the remaining eight patients all healed in a mean 66 days (range was not specified).

Two other evaluations have been undertaken, both presented as conference posters. In the first evaluation, 14 non-consecutive patients with either VLUs (n=9) or mixed-aetiology ulcers (n=5) trialled juxtacures for a 10-week period.⁴ Seven patients were treated in leg ulcer clinics and seven at home. The ulcers ranged from new presentations to chronic wounds of up to 2.5 years (no mean was given). Compression level applied ranged from 20–40 mmHg, based

on the ankle brachial pressure index (ABPI) and clinical presentation.

Five wounds healed and the rest improved. Four patients were able to self-care. Three of the five patients who healed chose to continue using juxtacures rather than hosiery. Eleven patients were able to tolerate the same or higher compression than previously used, but three changed to alternative types of compression due to a fall, personal preference or for the management of lymphoedema.

'I know the tension required and find it easy to get it consistent at each reapplication'

Patient from the Harris evaluation⁴

The poster describing the second evaluation simply reported that there was a measurable reduction in the size of VLUs and leg oedema in an unspecified number of patients following the switch from compression bandaging to juxtacures.⁵

Results of these evaluations are summarised in Table 1.

Efficacy: case studies

Several case studies have demonstrated how use of juxtacures has promoted healing in chronic VLUs. In almost all of the cases, it was the garment's ability to promote self-care that was instrumental in facilitating healing. Many of these patients had been unable to attend clinic visits, and so were labelled 'non-compliant', but all became adherent with the new therapy.

Table 1. Evidence on efficacy: evaluation results

Author	Sample characteristics	Wound duration	Follow-up period	Outcome following treatment with juxtacures
Published evaluations				
Wicks¹	Pilot study involving 16 patients with VLU who switched from compression bandaging to juxtacures	Mean: 23 months and 1 week	4 weeks	<ul style="list-style-type: none"> Signs of healing were observed within 4 days in previously recalcitrant wounds Reduction in exudate levels and need for superabsorbents Reduction in wet legs and associated malodour Patients were able to wear normal footwear, resulting in improved mobility 10/11 patients who gave feedback reported they were happy/very happy with juxtacures The 13 patients reported that, overall, it was associated with less pain than compression bandages
Wicks²	56 patients with VLU who switched from compression bandaging to juxtacures	≥12 months (mean not specified)	6 months	<ul style="list-style-type: none"> 14 patients with chronic VLUs healed within 6 months After 6 months, the percentage of healed VLUs on the caseload increased from a baseline of 19% to 39%, with the mean healing time reducing from 22 to 18 weeks In a subsample of 18 patients surveyed at week 4, 70% experienced less pain, 62% slept better and 80% had an improvement in their mobility and quality of life
Abstract				
Lurie³	10 patients	Not stated	Not stated	<ul style="list-style-type: none"> Two patients withdrew for reasons that were not related to juxtacures Eight patients healed in a mean of 66 days
Poster evaluations				
Harris⁴	14 patients: nine with VLUs and five with mixed-aetiology ulcers	Range: from new presentations to 2.5 years (mean not specified)	10 weeks	<ul style="list-style-type: none"> Five wounds healed and the rest improved. Three of the patients who healed opted to continue using juxtacures rather than hosiery Four patients were able to self-care Eleven patients were able to tolerate the same or higher pressure than was previously used Three patients changed to alternative types of compression therapy
Oates⁵	10 patients	Not stated	Not stated	<ul style="list-style-type: none"> Reduction in wound size and oedema Improved patient adherence and wellbeing Benefits included ease of use, ability to reduce pressure at night and to remove the garment before showering

VLU – venous leg ulcer

Addressing non-adherence relating to poor body image

A recently married 42-year-old woman with recurrent VLUs of 5 years' duration that often required hospital admission for cellulitis presented with a chronic sloughy VLU.⁶ She was clinically obese, which had contributed to her developing type 2 diabetes mellitus, and suffered from epilepsy. Her job required her to stand for long periods each day with little opportunity to sit or raise her legs. She

was non-adherent with compression therapy (bandages and hosiery), as she felt it had a negative effect on her body image and particularly resented that the bandages restricted her choice of shoes. The limited availability of nurses who could apply compression bandages correctly compounded this problem further.

At the time of her referral to a community nurse, the VLU measured 7.5x5.5 cm and was completely covered in slough. She had regularly experienced

bandage slippage and uncontrolled exudate, with no signs of healing/improvement, and so felt very despondent.

Both the patient and her practice nurse (PN) were shown how to apply juxtacures and found it easy to use. After 3 weeks, the wound reduced by 58%. By 6 weeks it had reduced by 90% and measured 3.5x1.2cm, with the wound bed comprising 50% slough and 50% granulation tissue. The patient's clinic appointments reduced from every other day to twice weekly. Bianchi⁶

Table 2. Efficacy: case studies

Author	Clinical challenges	Outcomes
Bianchi et al.⁶	<ul style="list-style-type: none"> Recurrent sloughy VLU of 5 years' duration prone to cellulitis. Job involved standing for long periods. Non-adherent with compression therapy due to body-image issues. Wound exudate was not controlled and bandage slippage was a problem Patient with a 20-year history of recurring venous leg ulceration was admitted to hospital with extremely painful, infected VLUs. The ulceration improved rapidly following intravenous antibiotics, pain relief and compression bandaging. Her aim now was to self-care while on holiday with her young grandson 	<ul style="list-style-type: none"> In 6 weeks, the wound size reduced by 90% (from 7.5x5.5 cm to 3.5x1.2 cm), with 50% reduction in slough and 50% increase in granulation tissue. The patient was able to self-care and non-adherence was no longer an issue The patient was able to achieve self-care with juxtacures and so achieved her goal of going on holiday with her grandson. Since then, she has continued to self-care with the garment
Dowsett and Elson⁷	<ul style="list-style-type: none"> Patient with a 10-year history of bilateral venous leg ulceration presented with a malodorous and extremely painful ulcer. Non-adherent with compression bandaging due to work-related issues but spent the evenings with legs elevated Housebound patient with 42-year-old history of bilateral venous leg ulceration. Swollen inverted champagne bottle-shaped legs and high exudate levels had necessitated daily dressing changes. Her 30-year-old son had to give up work to become her full-time carer 	<ul style="list-style-type: none"> The patient was able to self-care with juxtacures. The VLU healed in 8 months' during which time he was able to resume his normal work and social life, his depression disappeared and he was go away on holiday Swelling and exudate reduced to the extent that she could buy a new pair of shoes for a wedding. Both legs continued to heal and dressing changes reduced to once or twice weekly. Her son was able to retrain and seek full-time employment
Lawrence⁸	<ul style="list-style-type: none"> Patient with 10-year history of recurrent venous leg ulceration. She had been self-treating for the previous 2 years as was often unable to attend clinic appointments due to work-related issues. Presented with a static, moderately exuding VLU A young patient with large, swollen, inverted champagne bottle-shaped legs presented with a 120cm² VLU of 6 months' duration. The patient did not wear his compression bandages because they felt uncomfortable and kept slipping down under his trousers at work. The limb was too large for compression hosiery An 82-year-old man presented with weeping swollen feet and two heavily exuding, painful, mixed-aetiology ulcers on one leg. He was unable to tolerate compression therapy due to leg ulcer pain 	<ul style="list-style-type: none"> Able to self-care using juxtacures. At end of the (unspecified) follow-up period, the wound had almost healed The VLU healed with no recurrence within 12 months. Patient was adherent with both juxtacures and subsequent hosiery The patient was able to tolerate the lowest level of compression that juxtacures can accurately provide and to adjust the garment himself as the limb reduced in size. His foot oedema reduced with use of the anklet. At end of the (unspecified) follow-up period, the wetness and oedema had resolved, and the ulcer had improved

stated that, a few weeks later, the wound was 'close to healing'.

A key feature of this case is that the patient was actively involved in her care. Her quality-of-life issues were addressed and non-adherence was no longer an issue.⁶

Addressing non-adherence due to missed clinic visits

A 47-year-old man with a 10-year history of bilateral venous leg ulceration presented with a malodorous and extremely painful VLU.⁷ He was often unable to attend clinic appointments due to problems with taking unpaid leave from work, and so was labelled

'non-compliant'. Nevertheless, he had tried various compression systems and spent the evenings at home with his legs elevated. The nurses decided to try juxtacures in the hope that it would promote adherence.

Following the switch to juxtacures, the VLU healed in 8 months, during which time the patient was adherent with the treatment and the nurses regularly checked that it was being applied correctly. The patient's quality of life improved significantly while he was using the garment. His ulcer pain disappeared, as did the depression he had experienced previously. He was also able to take his

partner on holiday and resume a normal work and social life, none of which had been possible before. Following healing, he wore compression hosiery.

Speaking about his leg ulcer history before initiating treatment with juxtacures, the patient said, 'I have fought many battles, but never won the war'. After 8 months of treatment, he concluded that he had finally 'won the war'.

Accommodating workplace restrictions

A 52-year-old woman, who had experienced recurrent venous leg

Table 2. Efficacy: case studies (continued)

Author	Clinical challenges	Outcomes
Lawrence⁹	<ul style="list-style-type: none"> The patient presented with a very painful, exuding, non-healing mixed-aetiology leg ulcer measuring 5cm². He was a driver whose employer prohibited him from wearing compression bandages at work. At 6ft 2in, he was too tall for the compression hosiery kit system available. He therefore switched to the long-sized juxtacures 	<ul style="list-style-type: none"> The long size was able to accommodate the patient's height. The wound responded well to treatment in one month and at the time of writing was expected to heal
Nugent¹⁰	<ul style="list-style-type: none"> An extensive but superficial VLU, of 12 months' duration, measuring 200cm². As the patient was unable to attend appointments for work-related reasons, he was taught how to two-layer compression bandages himself. His tissue viability nurse was concerned he was not applying the correct pressure consistently, and so switched to juxtacures 	<ul style="list-style-type: none"> The patient found juxtacures comfortable and easy to use. The VLU reduced by 50% in 5 weeks and had almost healed in 10 weeks
Davies¹¹	<ul style="list-style-type: none"> A VLU of 18 months' duration. The patient stopped wearing compression bandages due to severe pain and loss of sleep. He required strong opiates and was taking antidepressants 	<ul style="list-style-type: none"> The VLU healed in 8 weeks and the patient was able to wear juxtacures at night throughout this period, adjusting it to a reduced pressure. After 2 weeks, his pain score reduced from 10/10 to 2/10, and he no longer required analgesia or antidepressants

VLU – venous leg ulcer

ulceration for over 10 years, was so frightened that she would lose her job as a school cleaner because of the ulcers that she self-treated for 2 years before seeking professional help.⁸ At this point, the VLU measured 8x5cm. She was prescribed four-layer bandages, but soon lost her job as she was unable to wear what her employer considered to be 'suitable, safe footwear'.

Despite this, the patient continued wearing the compression bandages, to which the VLU responded well. After approximately one month, she got a new job, but was unable to attend the clinic for regular dressing changes, and so the ulcer remained static. It was producing moderate volumes of exudate.

The patient's vascular specialist nurse recommended she try juxtacures so that she could self-care, rather than having to rely on staff to change the bandages. With support from the specialist, she quickly learnt how to apply both the garment and her dressings (a Hydrofiber foam to absorb the exudate and a barrier film to protect the peri-wound skin). She was able to self-care while at work, only attending clinic at her convenience. Lawrence⁸ reported that, at the time of writing, the wound had nearly healed, measuring 2x2 cm.

Mixed-aetiology leg ulcer

Juxtacures has also been found to be effective on mixed-aetiology leg ulcers. A 48-year-old man developed a very painful, exuding, non-healing, mixed-aetiology ulcer (ankle brachial pressure index (ABPI) 1.5) on the site of an old burn injury.⁹ It measured 2.5x2 cm and was surrounded by atrophie blanche and clearly visible varicose veins. Duplex scan showed that his arteries were patent and it was safe to apply compression therapy.

A driver by profession, this patient was not allowed to wear compression bandages while at work and none of the compression hosiery ulcer kits available fitted his tall frame (6ft 2in). It was therefore decided to use juxtacures, which is available in a long size. The anklet was also used.

The patient was taught how to apply the garment and change the dressing (an absorbent foam dressing with a soft-silicone border). This was assessed by the nurses after 1 week but, as there was very little oedema, only minimal adjustments were required.

The patient was pleased to observe an improvement in the wound after one month. The author reported that the wound was continuing to improve at the time of writing and was expected to heal.

Accommodating work, lifestyle and wound requirements

A 48-year-old man had an extensive but superficial 20x10 cm VLU of 12 months' duration.¹⁰ He was labelled non-concordant because consultations with his PN or district nurse (DN) clashed with his busy work schedule as an IT consultant, which involved frequent trips away, and he often failed to attend. To avoid taking time off work, he managed his wound care himself, applying dressings prescribed and supplied by his PN.

He was referred to a tissue viability nurse (TVN), who collaborated with the patient to devise a treatment plan that would accommodate his work, lifestyle and wound requirements. As part of this, he was taught how to apply a two-layer compression system over a simple absorbent dressing and an emollient cream over the peri-wound skin. Although the patient was adept in bandage application, the TVN was not confident he was consistently applying the level of compression required. Therefore, after one month, she switched to juxtacures, as its built-in pressure system (BPS) card would ensure he applied a consistent level of prescribed compression. The rest of his treatment regimen remained unchanged.

The patient was taught how to apply



Figure 1. Anterior aspect of the leg at the start of treatment with juxtacures



Figure 2. Lateral aspect of the leg at the start of treatment with juxtacures



Figure 3. Anterior aspect at week 3



Figure 4. Lateral aspect at week 3



Figure 5. Anterior aspect at week 5



Figure 6. Lateral aspect at week 5



Figure 7. Anterior aspect at week 8



Figure 8. The wound at week 9

juxtacures, and his wound and application of the garment were assessed at weekly visits, which were scheduled at the end of the week to fit in with his work commitments. The patient commented that he found juxtacures comfortable and easy to use, although he was unable to tolerate the (standard sized) ankle as it was too tight for his size 12 feet (a larger size has since been released). This did not result in oedema. He stated that the garment gave him more freedom of movement, especially in the foot, than did the previous compression systems.

'The ability to wear my own shoes is a bonus'

Patient who presented with an extensive but superficial VLU¹⁰

Over time, the dressing change frequency reduced from three times weekly to once a week. After 5 weeks, the wound had reduced in size by 50%, with the lateral and posterior aspects having healed. Some signs of overgranulation observed in the lower area of the wound bed at week 3 had 'settled'. After 10 weeks, it had almost healed, with only three small pockets of the original extensive ulcer remaining: these measured 3.0 x 2.8 cm, 1.4 x 1.6 cm and 2.9 x 1.9 cm. Figs 1–9 show the progression to healing.

The patient was able to manage the garment 'with ease', being able to remove, apply and launder it without any problems. He particularly appreciated the control it gave him over his wound. For example, the



Figure 9. The wound at week 10

garment enabled him to manage any malodour, as evident from this quote.

'If I felt the wound was a little smelly, I just had a shower and changed the dressing'

Patient who presented with an extensive but superficial VLU¹⁰

Severe pain resulting in sleepless nights

In this poster presentation, a 73-year-old male was prescribed multilayer bandages for a VLU of 18 months' duration, but this was discontinued after one year due to pain that was so bad (scoring 10 on a 10-point scale) that he could not sleep at night.¹¹ He required strong opiate analgesia and was taking antidepressants. The patient later said: 'If I had lived near a railway line, I would have thrown myself under a train.'

A TVN decided to trial juxtacures so that the patient could adjust the compression to a tolerable level and remove it at night, if desired.

After 4 days the patient commented that he found the garment comfortable and could sleep with it on, adjusting it to a reduced pressure. The oedema had reduced by 9 cm at the ankle and by 6.5 cm at the calf.

After 14 days, his pain score had reduced to 2 out of 10, and he no longer required analgesia or antidepressants. He was still sleeping with the garment on at night, applied at a reduced compression.

The wound healed in 8 weeks.

'The device is comfortable, allowing me to sleep through the night ... It has transformed my life'

Patient with severe pain that caused loss of sleep¹¹

Painful ulcers that could not tolerate compression

An 82-year-old man who, despite limited mobility mainly due to osteoarthritis and an old ankle injury, helped care for his wife and did all the shopping.⁸ Latterly, his ability to do this was compromised by swollen wet legs and feet, and two painful, heavily exuding, mixed-aetiology ulcers on the malleoli and gaiter areas of his left leg. ABPIs for his left and right legs were

0.64 and 0.75, respectively. The patient, who had 'reasonably well-controlled' type 2 diabetes, had peripheral vascular disease and neuropathy in his feet, but was deemed suitable for compression following specialist assessment.

Unfortunately, the patient found even low-level compression painful, particularly over the left ankle, and so it was stopped. Highly absorbent dressings were used, but these became saturated within one day. It was therefore decided to apply juxtacures to his left leg at the lowest level of accurate compression (20 mmHg) that the garment can provide. An absorbent Hydrofiber dressing was also used.

The oedema reduced rapidly during the first 2 days of treatment, and the patient was able to adjust the garment as necessary to ensure a good fit. Use of the foot ankle reduced the oedema in his feet, and did not restrict his ankle movement. He initially wore hosiery on his right leg but, as this resulted in an increase in exudate, he soon replaced this with juxtacures.

Lawrence reported that this patient was still wearing the garment at the time of writing (timeframes were not specified) as the wounds had not healed, but the wetness and oedema had resolved.⁸

Effect on oedema and ease of use on awkward-sized legs

Venous hypertension and subsequent ulceration are associated with oedema. As compression therapy addresses the cause of oedema, it often results in a rapid reduction in limb size. The clinical challenge is to avoid slippage.

Addressing high exudate and slippage that had required daily dressing changes

A 63-year-old woman with a 42-year history of bilateral venous leg ulceration and recurrent cellulitis had tried various compression systems, but very high exudate levels and slippage, linked to her inverted champagne bottle-shaped legs, necessitated daily treatment.⁷ She became mostly housebound, resulting in her 30-year-old son giving up work to become her full-time carer.

The nurses decided to try juxtacures on the right leg as it was the less severe of the two. The patient was willing to try the garment as it is designed to reduce bulkiness and would enable

her to wear non-orthotic shoes.

The patient noticed that the swelling had reduced and the wound was improving, so she requested that the garment be used on the other leg as well. The goal was to reduce the oedema and exudate sufficiently so she could buy a new pair of shoes for a wedding. The authors concluded that both legs 'continued to heal', with the improvement being so great that the patient's son was able to retrain and seek full-time employment. Her dressings were changed once or twice weekly, as required.

Non-adherence resulting from slippage

A morbidly obese 33-year-old male civil servant presented with a superficial, low exuding leg ulcer of approximately 6 months' duration on his left medial calf.⁸ The wound measured 12x10 cm. His ABPI was 1.02, and he had venous disease with oedema. Due to the inverted champagne bottle shape of his leg, application of both two-layer and four-layer compression bandaging was difficult. The patient found the bandages uncomfortable to wear with his suit and dress shoes at work. It was particularly embarrassing when the bandages slipped down or felt uncomfortable around his ankles. As a result, he became non-adherent with the compression therapy, even though he understood the need for it.

As the limb was too large for hosiery, the nurses decided to try juxtacures, which could accommodate his limb size and be adjusted by the patient himself. The garment was applied over a simple, non-adherent wound contact layer. The author reported that the 'patient's leg responded well to the wrap and healed' (the timeframe is not specified). The patient subsequently wore compression hosiery and continued to attend his leg ulcer clinic appointments, with no recurrence within the next 12 months.

Effect on quality of life and wellbeing

Not being able to wear normal shoes when wearing compression bandaging, and other associated restrictions, such as limited ankle movement and not being able to remove the bandages before showering and at night, can reduce patient independence and result in low mood.

Feedback from evaluations

The pilot study and subsequent evaluation undertaken by Wicks, which compared the clinical outcomes achieved after switching from compression bandaging to juxtacures, are described above.^{1,2} The evaluator also elicited data on the patients' satisfaction with juxtacures and its effect on quality of life and wellbeing.

In the initial pilot study involving 16 patients, 11 gave feedback after the first fitting of juxtacures.¹ All but one were happy or very happy with the garment. The patient who was the one exception later changed his mind when his oedema reduced over the course of the 4-week evaluation and he was able to wear his own shoes again. He even got his car fixed so that he could go shopping, and became confident enough to participate in his grandson's childcare.

Thirteen patients indicated that juxtacures was not associated with less pain than the compression bandages they had used previously: 11 stated it was associated with no or little pain and two with moderate pain; whereas six stated that bandages were associated with bad or very bad pain, six cited moderate pain and one patient no pain. Reasons for the non-responses are not given.

Wicks also reported that being able to wear their normal footwear with the garment had a 'big psychological impact' on the patients, while the ability to check and adjust the pressure applied improved their sense of being in control.

'I now feel able to walk down to the communal dinner for my meals'

'I can now get into proper clothes rather than staying in my pyjamas'

'Finding the socks painful and as there is no swelling in feet, trying without socks. Legs very comfortable'

'Holds better than bandages'

'I previously needed three dressing changes... each day due to high exudate'

Patients from Wicks's pilot study¹

Following the pilot study, the author implemented a conversion programme offering juxtacures to all patients with VLUs in her region. The impact of the garment on quality of life was assessed on 18 patients at week 4 (the selection criteria was not specified). The results show that, following the switch to juxtacures, 70% of wearers experienced less pain and 62% slept better. Some 80% stated that the garment had improved their quality of life for reasons including that they could wear their normal footwear, put their socks and trousers on over the garment, and their balance, gait and stability had improved, resulting in greater mobility. One patient said he was able to get dressed and have lunch with his friends for the first time in 2 years. Their ability to self-care improved feelings of being in control.

The poster evaluation by Harris, which involved 14 patients with chronic wounds who trialled juxtacures, is described above. The majority (exact number not given) of patients stated that use of juxtacures improved quality of life, with comments including that they were able to resume driving, could shower more regularly, wear their own shoes and that the garment was more comfortable to wear than compression bandages in warm weather. There were also comments that juxtacures was less embarrassing to wear than bandages.

'Not being able to wash my leg every day while in bandages is like not cleaning my teeth'

'I can shower twice a day now'

'Not as embarrassing as bandaging'

'100% improvement—able to wear my everyday shoes'

'Self-management helps as taking time out for appointments is difficult'

Patients from Harris's evaluation⁴

wellbeing, as evidenced by patients' greater mobility as a result of being able to wear their normal shoes again, and the facility to temporarily reduce pressure at night and remove the garment before showering.

Making holidays a reality

A 65-year-old patient had had recurrent leg ulceration since her late forties. This had steadily deteriorated in the past 5 years, causing extreme pain, and became infected with multi-resistant pathogens. The patient had type 2 diabetes mellitus, hypertension and hypothyroidism. Other skin conditions included pyoderma gangrenosum, necrobiosis lipoidica diabetorum and psoriasis.

The patient was admitted to hospital for 10 weeks, during which time the VLUs improved rapidly following administration of IV antibiotics and pain relief, and application of multilayer bandaging.⁶ While she was, of course, delighted with her progress, she was worried about how she would cope during a forthcoming holiday with her young grandson. She was therefore given juxtacures, so that she could continue her compression therapy while away. She was not only able to successfully self-care during the holiday, but since then has continued to use it to self-care with support from her DN.

All case study evidence on efficacy is summarised in Table 2.

'It has changed my life considerably. I no longer need to take pain killers ... and I have more energy. The biggest impact was being able to take my grandson on holiday, and my husband and I now visit him weekly. I can bathe or shower when I want to and dress my own legs afterwards. Bandages weighed my legs down dreadfully: juxtacures feels light to wear ... Dressing my legs used to take an hour with bandages, now it takes less than 30 minutes.'

Patient who self-cared while on holiday⁶

Similar comments were reported in Oates's poster evaluation,⁵ which highlighted improvements in patient adherence with treatment and improved

Ease of use and cost-effectiveness

Clinicians are expected to prove that they can achieve optimal clinical

outcomes as cost-effectively as possible. In terms of compression therapy, factors such as the frequency and duration of nurse visits, and dressing change frequency will determine cost-effectiveness.

The first evaluation

Like many inner London trusts, Camden Integrated Primary Care (IPC) service had a high staff turnover, which intermittently resulted in insufficient staff available who were qualified to apply compression bandages. After seeing juxtacures at an international conference exhibition, Sue Elvin, Nurse Consultant in District Nursing, undertook a 6-month evaluation investigating whether or not its use in the IPC would be cost-effective.¹²

Thirty patients (all housebound) from the existing caseload considered to be suitable for juxtacures were identified for inclusion. All had been receiving compression therapy. The DNs and community nurses received training from medi staff on how to apply the garment, with both then training the patients on application. The garment was adjusted by a DN when the patients were unable to do this themselves.

The costs associated with the use of the previous compression regimen (generally multilayer bandages) in the 6 months before the introduction of juxtacures were compared with those incurred in the subsequent 6 months.

Calculations were based on the cost of the compression system used (it was assumed that each juxtacure would last 6 months, as stated by the manufacturer), the cost of the wound dressing used and the nursing time spent with the patient per week. Data for the 6 months in which the multilayer bandages were used were taken from the patients' notes. Full comparative data were available for 26 patients.

- Juxtacures was cheaper to use than compression bandages over 6 months: reducing from £20,131 to £5581, saving £14,550. The frequent reapplication and disposal of compression bandages made them more expensive in the long-term. Twenty-five of the 26 patients (96%) incurred lower compression costs during the juxtacures phase of evaluation
- Costs of absorbent dressings also fell

during the 6 months in which juxtacures was used, reducing from £9701 to £4318, saving £5383. It was assumed that use of the BPS enabled consistent application of the correct pressure, which in turn reduced the exudate volumes

- Following the switch to juxtacures, the number of nurse visits reduced by two-thirds per week over 6 months (from 82 to 54), with a steady monthly reduction. Twenty patients (77%) required fewer visits, with the remaining 6 patients requiring the same number of visits (not more) as before. Similarly, 23 patients (88%) required shorter visits, and none needed longer visits.
- Nursing time spent on patient visits fell in the 6 months after the switch to juxtacures, reducing from a total of 55 hours and 16 minutes for 6-month period in which multilayer bandages were used, to 22 hours and 50 minutes, saving 32 hours and 26 minutes.

The second evaluation

Freeman and Norris¹³ described how their London trust faced similar challenges as those described above by Elvin.¹² The trust was heavily reliant on agency nurses, resulting in the permanent nurses not having enough time to attend courses on compression bandaging. There were reports of trauma resulting from poor bandage application.

Inspired by Elvin's evaluation, Freeman and Norris undertook a 7-week evaluation to determine the clinical efficacy and cost-effectiveness of juxtacures. The patients, who were referred from a tissue viability complex wound clinic, had to meet the following inclusion criteria in order to participate in the evaluation:

- Have an ABPI between 0.8 and 1.3
- Have undergone a full lower limb assessment
- Be able to self-care or have carers
- Be mobile
- Not have severe oedema or gross dorsum oedema
- Have a relatively well-shaped lower limb
- Have well-controlled exudate volumes.

Sixteen patients met the inclusion criteria. There was no inclusion/exclusion

relating to the type of compression therapy used previously, and it was apparently assumed the patients would have been wearing compression bandages.

The community nurses were trained by a TVN on how to apply juxtacures, and then accompanied by a member of the medi clinical team during the first patient visit (for the fitting) and the first follow-up appointment. Thereafter, they worked independently.

Data were only available for 9 of the 16 patients (56%), mainly because staff issues affected the data collection.

Six of the nine patients found the range comfortable and wanted to continue using it after the evaluation ended. Two of these patients were discharged as they were able to self-care. Previously, they had been unable to apply compression hosiery, relying on weekly nurse visits.

Of the remaining three patients, one wanted to revert back to bandages as they were unable to wash/care for the garment, and two wanted to go back to hosiery (one had been applying compression hosiery independently before entering the evaluation and the other was included despite having dorsum oedema, suggesting both should have been excluded). No data were provided on healing outcomes.

In terms of cost-effectiveness, during the evaluation there was an overall reduction of seven visits per week for the nine patients (no comparative data were given). The average visit time per patient reduced from 40 minutes for compression bandages, as documented in the patients' electronic medical records over an unspecified time frame, to 19 minutes for juxtacures. The authors estimated this saved 4 hours and 40 minutes of nursing time per week. The authors noted that, overall, the patients were able to adjust the garments independently.

Other evaluations

Both the pilot study and subsequent 6-month evaluation undertaken by Wicks are described above.^{1,2} Both papers included data showing that the introduction of juxtacures resulted in cost savings.

The pilot study, which involved 16 patients, revealed that juxtacures achieved an average saving of £60.88 in the cost of wound dressings and compression per patient per week.

This was attributed to a reduction in dressing usage. In addition, use of the garment resulted in shorter patient visits, with an average time saving of 87 minutes per patient per week.

The subsequent 6-month audit compared the costs incurred for six patients in the 6 months before and after juxtacures was introduced (the selection criteria for these six patients were not specified). The total spend on wound dressings and compression bandaging for these patients in the 6 months before the conversion programme was £4323, which reduced to £1928 over the next 6 months when juxtacures was used, with a total saving of £2395. Wicks concluded that the significant reduction in exudate volume observed with juxtacures resulted in fewer dressing changes.

In her multicentre evaluation, presented as a conference poster, Elson described the cost savings associated with the use of juxtacures on 17 patients with static or deteriorating VLU previously treated with

standard compression therapy.¹⁴

After 6 months of treatment with juxtacures, all 17 patients showed signs of improvement in the condition of the their ulcers.

To calculate and compare costs for juxtacures versus standard compression therapy, the following data were recorded:

- Number of nurse visits
- Patient quality of life
- Type and number of wound dressings used
- Compression bandaging type and number used.

Where patients had not used compression garments for 6 months before switching to juxtacures, an estimate was used.

Based on the data collected (outlined in Table 3), Elson calculated total costs of £6570 for standard care and £1762 for juxtacures, producing a saving of £4808 for the 17 patients or £282.82 per patient. Elson did not specify the timeframes for these sets of costs, but it can be assumed they cover 6-month

periods.¹⁴ Similarly, the sources for the prices were not stated.

'This treatment freed up the medical profession as my clinic appointments have reduced from an hour twice a week to 20 minutes once a week'

Patient from the Elson evaluation¹⁴

Nugent, in her case study, reported that the treatment costs incurred during the 12 months before the introduction of juxtacures were £3300, compared with £732 for the period in which the garment was used.¹⁰ Other authors simply stated that the use of juxtacures resulted in cost savings, but either did not provide supporting data for this or did not clarify the context for the data provided.^{4,6}

The evidence on cost-effectiveness is summarised in Table 3.

Author	Setting	No. of patients	Objectives	Outcomes
Elvin¹²	Integrated inner-city primary care service where a high staff turnover resulted in insufficient staff who had been trained to apply compression therapy. Switched to juxtacures as it does not require specialist training to apply	n=30	Cost of the previous compression regimen (generally multilayer bandages) versus that of juxtacures in the 6 months before and after the switch	<ul style="list-style-type: none"> • Over 6 months, juxtacures was more cost-effective than the multilayer bandages: £5581 vs. £20,131, saving £14,500 • Cost of absorbent dressings also reduced: £4318 vs. £9701, saving £5383 • The number of nurse visits per week over 6 months reduced from 82 to 54 • Of the patients, 77% required fewer visits and 88% needed shorter visits during treatment with juxtacures • The total saving in nursing time during visits was 32 hours and 26 minutes
Freeman and Norris¹³	An inner-city primary care service that relied heavily on agency nurses	n=9	To determine the clinical benefits and cost savings achieved over 7 weeks	<ul style="list-style-type: none"> • Six patients found juxtacures comfortable and wanted to continue using it after the evaluation ended • Two of these patients were discharged as they were able to self-care • The nine patients required seven fewer nurse visits per week • Average visit time per patient visit reduced from 40 minutes to 19 minutes • The authors calculated this amounted to a weekly saving of 4 hours and 40 minutes in nursing time

(continued over)

Table 3. Cost-effectiveness studies (continued)

Author	Setting	No. of patients	Objectives	Outcomes
Wicks¹	Community	n=16	Pilot study to determine the impact of juxtacures on time spent on patient visits	<ul style="list-style-type: none"> Use of juxtacures resulted in an average cost saving of £60.88 per patient per week in terms of wound dressings and compression Use of the garment resulted in shorter patient visits, with an average time saving of 87 minutes per patient per week
Wicks²	Community	Evaluation: n=6 (taken from a sample of 56 patients)	An audit was undertaken on 56 patients. Six patients were selected for an analysis comparing the costs of compression therapy in the 6 months before and after the switch to juxtacures	<ul style="list-style-type: none"> Total spend on primary and secondary wound dressings before and after the switch was £4323 and £1928 respectively, resulting in a cost saving of £2395 for juxtacures over 6 months The significant reduction in exudate volumes observed with juxtacures resulted in fewer dressing changes
Elson¹⁴	Multicentre (settings not specified)	n=17	Trial comparing data 6 months before and after the introduction of juxtacures	<ul style="list-style-type: none"> Within 6 months, all patients' ulcers had improved, experiencing an enhanced quality of life Average cost of dressings reduced from £826 to £72* Average cost of compression bandages reduced from £1073 to £193* Associated nursing costs reduced from £4671 to £1497* <p>This resulted in an average saving of £4808 for the 17 patients (£282.82 per person)</p>

*Neither the source of the costs nor the time periods were specified, although it is assumed the latter was 6 months

Conclusion

The evidence summarised here demonstrates that the comfort and ease of use associated with juxtacures results in increased patient adherence with treatment. Despite its high unit cost, use of the garment over 6 months was associated with a reduction in the frequency and duration of nurse visits as well as in dressing costs.

The rest of this supplement comprises new case study evidence on the impact of juxtacures on patient adherence and efficacy. All patients included in the case studies gave permission for the cases and images of their wounds to be published.

References

- Wicks, G. An alternative to compression bandaging in venous leg ulcers. *JCN* 2015; 29: 1, 40–6.
- Wicks, G. Innovative compression therapy systems can improve practice. *GPN* 2016; 2: 3, 26–7.
- Lurie, F., Kistner, R.L., Kennerknecht, T. Juxta-CURES deemed as a favourable treatment solution for venous ulcers. *Wound Care Therapies* 2012; 1: 1, 1.
- Harris, H. Using an innovative compression system to improve patient concordance and quality of life whilst achieving clinical and financial outcomes. Poster presented at Wounds UK, Harrogate, 2013.
- Oates, L., Ranton, A., Roberts, D. Improving patient and nurse experience: a simple measurable graduated compression device. Poster presented at Wounds UK, Harrogate, 2013.
- Bianchi, J., Mahoney, K., Nugent, L., Keen, D. A fresh way to treat venous leg ulcers with measured compression. *Br J Community Nurs* 2013; Suppl. 34: S36–40.
- Dowsett, C., Elson, D. Meeting the challenges of delivering leg ulcer services. *Wounds UK* 2013; 9: 1, 90–5.
- Lawrence, G. Juxtacures: an innovative method of providing compression for leg ulcer management. *Wounds UK* 2014; 10: 1, 64–70. <https://tinyurl.com/hz2fdac> (accessed 26 February 2017).
- Lawrence, G. Juxtacures™: when is it appropriate? *Wound Essentials* 2014; 9: 2, 30–6.
- Nugent, L. Juxtacures: compression for healing venous leg ulcers. *Br J Community Nurs* 2013; 18 (Suppl. 9): S40–5.
- Davies, L. A novel compression device: improving patient quality of life. Poster presentation at Wounds UK, 2013, Harrogate, UK. <https://tinyurl.com/gnk6jt6> (accessed 26 February 2017).
- Elvin, S. Cost efficacy of using Juxtacures™ and UCS™ debridement cloths. *JCN* 2015; 29: 2, 62–5.
- Freeman, N., Norris, R. Using an adjustable compression system to treat community leg ulcers. *JCN* 2016; 30: 3, 47–52.
- Elson, D. The 21st century approach for cost effective healing of venous leg ulcers. Poster presented at the Wounds UK Conference, November 2012, Harrogate, UK. <https://tinyurl.com/h7zb7p2> (accessed 26 February 2017).
- National Institute for Health and Care Excellence. The Juxtacures adjustable compression system for treating venous leg ulcers. NICE, 2015. <https://tinyurl.com/zqmjlev> (accessed 26 February 2017).

Case study 1: patient who disliked home visits

Sharon Hunt, Lead Advanced Nurse Practitioner and Independent Specialist Wound Care, Wellway Medical Group, Northumberland

An unemployed 52-year-old female who lived alone fell and caught her shin on some furniture, resulting in a skin tear that developed into an ulcer. The patient was a heavy smoker, obese with a body mass index (BMI) of 34, and had a history of controlled hypertension. She initially self-cared with an over-the-counter latex-free surgical dressing but later sought advice from her practice nurse.

Following Doppler investigation, venous insufficiency was diagnosed and the patient was prescribed four-layer compression bandages, which a district nurse (DN)

changed once weekly during home visits. Unfortunately, the patient reported that her peri-wound skin had become itchy and irritated, and that she felt 'trapped' by the compression bandages, which she described as 'bulky'. She therefore kept removing or loosening the bandages, which impaired healing. She wanted more control over the treatment, and did not like having to stay at home for the weekly DN visit.

After 4 weeks, at the suggestion of the DN, the patient attended a consultation with the lead advanced nurse practitioner (LANP) at her general practitioner service. She presented with an acute circumferential wound located on the left mid-tibial crest, which measured 13x23cm and was 0.4cm deep at the central point. The wound bed was sloughy and producing heavy serous exudate (Fig 1), there was widespread erythema and the patient was in extreme pain (10/10). In addition, she felt frustrated and irritated that the ulcer prevented her from wearing tights and skirts.

The LANP discussed with the patient alternative options to aid venous return, such as a two-layer compression bandaging system or juxtacures. As the patient wanted to be able to control her therapy independently, rather than relying on others during home visits, she opted for juxtacures, which was used along with a bordered foam dressing with a soft silicone contact layer. The LANP

gave the patient written information on the garment and how to use it. The patient practised applying it in the surgery until she and the LANP were confident she could do this correctly, and was told she could access the surgery if any issues arose. The LANP explained the care pathway to the patient, who agreed to adhere to it. At this stage, she accepted smoking cessation advice.

The patient was adherent with the therapy, and the VLU improved over the next 4 weeks, with reductions in size, exudate volume and pain (Table 1 and Figs 2–3). The dressings were changed every 72 hours during week 1, twice weekly in weeks 2–3 and then once weekly as the exudate volume reduced. This had a positive effect on the patient's quality of life. Both the patient and her DNs were satisfied with the product, and were happy to continue using it, as they found it easier to apply than expected.

'When I first opened the packaging it appeared very complicated; once I had separated out the components and read the instructions, it was a lot clearer and I found it very easy to apply'



Figure 1. The wound on day 0



Figure 2. The wound on day 14



Figure 3. The wound on day 28

Table 1. Improvements observed during 4 weeks of treatment with juxtacures

Date	Length (cm)	Width (cm)	Depth (cm)	Condition of the peri-wound skin	Pain score	Exudate level
Day -14	13.0	23.0	0.4	Macerated, wet	10/10	Severe
Day -7	13.0	23.0	0.4	Macerated, wet	10/10	Severe
juxtacures applied						
Day 0	13.0	23.0	0.4	Macerated, wet	10/10	Severe
Day 7	12.0	20.0	0.3	Macerated	10/10	Severe
Day 14	7.5	17.0	0.3	Moist healing	7/10	Moderate
Day 21	6.0	15.0	0.2	Moist healing	4/10	Moderate
Day 28	4.0	10.5	0.2	Moist healing	4/10	Low

Case study 2: patient who could not tolerate compression bandages

Sharon Hunt, Lead Advanced Nurse Practitioner and Independent Specialist Wound Care, Wellway Medical Group, Northumberland

A 75-year-old male with a painful recurring venous leg ulcer (VLU) on his right mid-tibial crest was referred by his district nursing team to a general practitioner (GP) service. The ulcer, which was 8 months old, had been treated with a four-layer bandaging system but was slow to heal. The patient had been able to tolerate the compression bandages until he developed moderate oedema in the lower limb as a result of a respiratory infection, for which treatment included steroids and bed rest. This, combined with the fact that he had difficulty fitting into his usual shoes, reduced his mobility and led to his decision to stop wearing the bandages.

The patient had a 10-year history of intermittent venous ulceration, which had

been successfully managed with various compression regimens. Comorbidities included long-standing hypertension (controlled with medication), hypercholesterolaemia and stable diabetes mellitus type 2 (HbA1c 7.9mmol). He was a non-smoker and had a satisfactory body mass index (BMI) of 26.

At presentation, the total ulcer area measured 18x6.5 cm, and was characterised by multiple small breaks in the epidermis and moderate serous exudate (Fig 1). The surrounding skin was dry and irritated. The ulcer was extremely painful (8/10), with the patient reporting that application of any layer of compression therapy exacerbated the pain. Previous dressings used by the district nursing team had included a bordered foam dressing with a soft silicone contact layer (changed every 48 hours) and, latterly, a basic dressing product.

Following discussion with the lead advanced nurse practitioner (LANP) at the GP service about the benefits and objectives of juxtacures and reading a patient information leaflet on it, the patient agreed to trial the therapy. The garment was applied and adjusted by the LANP during the patient's regular (pre-planned) visits to the GP centre. In addition, the patient was able to adjust the garment himself between visits if necessary, and was aware that he could contact the surgery with any concerns. The

bordered foam dressing with a soft silicone contact layer was also used. On average, the LANP changed the garment twice weekly for the first 2 weeks and then weekly as the exudate level reduced.

The patient found the garment comfortable to wear as it felt less tight, and less bulky and heavy when walking when compared with the previous system. The ulcer pain and exudate levels improved; Fig 2 illustrates the improvement achieved by week 28. The patient was able to wear his normal footwear and mobilise, and so experienced little interruption to his normal daily activities. Nevertheless, his mobility remained reduced as the oedema was still present, as would be expected when recovering from a respiratory infection. He continued to receive support from the district nursing team and the LANP, and was adherent with the therapy and wound care. Table 1 summarises the improvement in the condition of the wound during the 4-week follow-up period.

'This new leg treatment fits over my swollen leg and so I could manage my usual walking around my house and up the stairs'



Figure 1. The wound on day 0



Figure 2. The wound on day 28

Table 1. Improvements observed during 4 weeks of treatment with juxtacures

Date	Length (cm)	Width (cm)	Depth (cm)	Condition of the peri-wound skin	Pain score	Exudate level
Day -14	18.0	6.5	0.4	Irritated, red	7/10	Moderate, serous
Day -7	18.0	6.5	0.4	Irritated, red	7/10	Moderate, serous
juxtacures applied						
Day 0	18.0	6.5	0.4	Irritated, red	8/10	Moderate, serous
Day 7	16.0	6.0	0.3	Irritated	6/10	Moderate, serous
Day 14	10.0	3.0	0.2	Dry	4/10	Moderate, serous
Day 21	8.0	2.8	0.2	Dry	4/10	Low, serous
Day 28	4.0	2.0	0.1	Dry healed	2/10	Low, serous

Case study 3: infected, non-healing venous leg ulcer

Elaine Harris, Nurse Practitioner, Bobblestock Surgery, Hereford

Following a fall from a ladder, a 54-year-old woman developed a leg ulcer on the gaiter area of her left leg, which had an inverted champagne bottle shape. Her practice nurses (PNs) applied a non-adherent dressing impregnated with 10% povidone-iodine, but the wound failed to heal, and, after 2 months, they switched to a honey dressing in the hope that it would help debride the wound bed. A stockinette (blue-line) was used as a secondary dressing. The wound was so painful that the patient was unable to tolerate Doppler assessment. She was given codeine, which had little effect. The patient had no history of leg ulceration; her comorbidities included type 2 diabetes, which was well controlled with medication, and clinical depression.

The ulcer now measured approximately 5x7cm and had various cavities extending down to the deep muscle layer. The wound bed was covered with slough and was producing large volumes of malodorous exudate. The wound edges were undefined and surrounded by 5cm of spreading erythema. The wound was extremely painful, and the entire leg was hot and grossly oedematous. The excess exudate had resulted in excoriation of the peri-wound skin.

The patient was forced to give up her job as a peripatetic care assistant as she was no longer able to drive, and relied on a mobility scooter when leaving the house. The loss of income caused her some financial difficulties; her mood was low and she was often tearful.

The PNs referred the patient to a nurse practitioner (NP) at a different general practice surgery for urgent debridement and Doppler assessment. The NP undertook a full leg ulcer assessment in accordance with local guidelines. Bloods were also taken and a wound swab was sent for culture.

As the wound was still too painful to tolerate Doppler assessment or any form of mechanical debridement, larval therapy was undertaken. The larvae successfully removed the slough within 3 days. The wound now measured 8x4x2cm (Fig 1). The cavity was filled with a Hydrofiber dressing, over which

an absorbent foam dressing was applied. A barrier cream was used to protect the peri-wound skin. The patient could now tolerate Doppler assessment, which revealed that each leg had an ankle brachial pressure index (ABPI) of 1.0, which is indicative of a venous aetiology.

Meanwhile, the NP prescribed codeine and tramadol to relieve the pain, but these proved inadequate, and the patient was also given amitriptyline to take at night. The patient reported that she was sleeping better, but breakthrough pain was a problem, for which she was prescribed Oramorph (morphine). The swab results were positive for group G streptococci and Proteus, for which oral amoxicillin was prescribed.

Following discussion with the patient, it was decided to use juxtacures as compression therapy, as the NP had found it effective on other patients. The NP taught the patient how to apply and adjust the garment. The patient quickly became adept at application, and was able to remove the garment each day before washing her leg and applying the emollient. She was also able to readjust it as the lower limb reduced in size.

The flexible nature of the garment enabled her to resume driving. After 1 week, the calf had reduced by 4 cm and the ankle by 3 cm. The wound bed remained clean and the exudate volume had reduced to minimal, resulting in a dramatic improvement in the condition of the peri-wound skin. The pain was now well controlled. The patient's mood also improved.

The patient stopped taking Oramorph after 3 weeks of treatment (Fig 2). At week 4 the wound had reduced in size by 50% and there was clear evidence of granulation tissue formation (Fig 3). At week 6, the wound measured 2x2x4 cm, and the patient was now able to reduce her medication to codeine only (Fig 4). At week 8, the ulcer had healed and the patient was discharged from the NP's care with a long-term prescription for compression stockings and a date for a re-assessment at 3 months. The patient has since returned to work and her mood remains positive and happy.



Figure 1. The venous leg ulcer after one week of larval therapy



Figure 2. The same ulcer after 3 weeks of treatment with juxtacures



Figure 3. The ulcer after 4 weeks of treatment with juxtacures



Figure 4. The ulcer after 6 weeks of treatment with juxtacures

Case study 4: patient with a history of deep vein thrombosis and pulmonary embolism

Laura Hodgman, Vascular Nurse Specialist and Senior Clinical Education Facilitator, Royal Derby Hospital

This case study concerns a 37-year-old man with non-healing venous leg ulcers (VLUs) on his lower leg and foot. The patient has a history of deep vein thrombosis (DVT), pulmonary embolism (PE), venous thromboembolism and congenital protein S deficiency (protein S is a blood clotting disorder that increases the risk of DVT and PE). He had developed DVT and PE at a young age, destroying his hopes of becoming

a professional footballer. His medications included lifelong warfarin, which he took intermittently. He has had multiple leg ulcers since he was 18, sometimes resulting in cellulitis. His attendance for practice nurse/general practitioner (GP) and hospital appointments was poor, often because he found it difficult to take time off work to attend.

Over the years, he had used four-layer compression bandages and a variety of wound dressings, including manuka honey, alginates and hydrogels, when a VLU occurred. The compression bandages needed to be replaced regularly because of the high volume of exudate but, due to problems getting a nurse appointment at a mutually convenient time, he stopped using the dressings and compression therapy and self-treated in his

own way. The leg ulcers were often very painful, and he struggled with low moods, for which he required professional help.

The patient was admitted to a vascular ward with three extremely painful, chronic VLUs of more than 18 months' duration and a more recent VLU of one month's duration. It was suspected that an element of cellulitis was involved. His pain score was 9/10 – this being the principal reason for his admission. He was prescribed pain relief and intravenous antibiotics, plus strict bed rest with leg elevation. The wounds soon improved, and he was referred to the vascular nurse specialist.

The largest ulcer, which was located on the shin, measured approximately 10 x 7 x 2.5 cm and was completely filled with slough (Fig 1). In addition, there were two



Figures 1–3. The four wounds following administration of intravenous antibiotics, leg elevation and bed rest, and before the first application of juxtacures



Figures 4–6. The same wounds after 8 weeks of treatment with juxtacures



Figures 7–9. The same wounds after 10 weeks of treatment with juxtacures

areas of sloughy ulceration on the lateral aspect of the foot, each measuring approximately 5 x 4 cm (Fig 2). The new ulcer, which was the most painful, was on the medial aspect of the ankle and measured approximately 2 x 2 cm (Fig 3). All ulcers were producing heavy volumes of exudate, so the surrounding skin was extremely fragile and painful, and at risk of breakdown.

The vascular nurse specialist prescribed juxtacures and showed the patient an educational video about the garment and taught him how to apply it. The patient was quickly able to self-manage and wore the

garment every day. During the 4-week follow-up period, the slough started to lift from the wounds and there was a marked reduction in both the volume of exudate and ulcer sizes (Figs 4–6). In addition, not only did the patient's ongoing pain improve, but he was also able to tolerate dressing changes without morphine. He was able to spend more quality time with his young son and wear normal shoes. Figs 7–9 show the improvement after 10 weeks of treatment. He is now fully adherent with his compression therapy, and only attends check-ups if he has any concerns or wants

an assessment. This has, in turn, freed up time at his local GP surgery.

'juxtacures has made a massive difference to my daily routine, my ability to go to work, wear normal work shoes and has helped decrease the size of the ulcer'

Patient with a history of deep vein thrombosis and pulmonary embolism

The evidence on juxtacures is written by clinicians, based on their experiences of using the garment and its effects on patient outcomes. It comes mostly from community settings and comprises mainly case series, plus a few evaluations on its clinical efficacy and cost-effectiveness.

Despite the heterogeneity of the authors and settings described, several common themes emerge. In almost all cases, use of juxtacures was found to enable patients to self-care, which increased adherence with treatment and thus helped to promote healing. In many cases, full healing was achieved in what had previously been slow-healing or recalcitrant wounds that had severely impaired quality of life.

Patients' ability to self-care was related to the ease with which juxtacures can be applied. This enabled them to adjust the garment as and when needed – for example, as their oedema reduced, before showering and at night if this helped them sleep.

For patients, key benefits were the reduction in the number of nurse visits or the need to attend clinic for dressing changes, which often caused problems when scheduled during a busy working week. Many patients specifically stated that being able to self-care both at work and at home was central to achieving a good clinical outcome.

Clinicians consistently commented on the ease with which juxtacures can be applied, and the consistent accuracy of the

compression achieved, regardless of the user. When used over 6 months, it was found to reduce the frequency and duration of clinic visits, as well as the number of wound dressings used. There is potential for the resulting cost savings to be used to improve other aspects of clinical care.

The limitations in the evidence must be acknowledged. These include small sample sizes, lack of comparators, and insufficient information on the inclusion and exclusion criteria used, while many of the cases were not peer reviewed.

However, the evidence as a whole makes a strong case for the benefits of juxtacures, particularly for patients wishing to self-care. This is supported by many powerful patient testimonials.

Conclusion



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