

# Two-component compression: Concordance, evidence and clinical use



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# UNDERSTANDING ADHERENCE AND CONCORDANCE IN COMPRESSION THERAPY

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### Box 1 | Defining common terminology

**Compliance** — the degree to which patient behaviour matches a healthcare provider's advice; no longer in use, as the terminology is considered to come from a punitive viewpoint.

**Adherence** — the extent to which patients follow the instructions they are given for prescribed treatments (Bissonette 2008); preferred, as the terminology is considered more neutral with regard to judging patient actions.

**Concordance** — the degree to which the relationship and treatment regimen decision-making between patient and provider results in the desired treatment outcomes, preferred because it emphasises the factors that affect patients' choices.

*Adapted from Horne et al, 2005.*

### Box 2 | Elements of concordance

Moffatt (2004a) describes the three essential elements that are required to achieve concordance:

- Patients have the knowledge to participate as partners in their care
- The consultation involves the patient
- Patients' decisions are respected, and patients are supported during treatment.

## INTRODUCTION

In the absence of corrective surgery, compression therapy has been found to be the most effective treatment for venous leg ulcers (VLUs) (Nelson et al, 2000; WUWHS, 2008; O'Meara et al, 2012). Achieving healing rests on patients' adherence to treatment. However, a large body of evidence shows they do not always do so (Bland, 1996; Chase et al, 2000; Edwards, 2003; Mudge et al, 2006, Raju, 2007; Van Hecke, 2010). Adherence to compression is multifactorial and complex; the following briefly reviews some of the factors that affect whether patients carry out treatment regimens for VLUs.

## CONCORDANCE — JUST A SHIFT IN SEMANTICS?

In recent times, the terms 'non-compliant' and 'compliant' have been replaced with 'adherence', 'non-adherence' and, more recently, 'concordance' within healthcare (Box 1). 'Concordance' is now often used as a synonym for compliance or adherence in the literature; however, this is incorrect (Jull et al, 2004; Moffatt, 2004a and 2004b; Anderson, 2007; Van Hecke, 2010). This is not just a problem of semantics, as the terms 'adherence' and 'compliance' reflect different perspectives of the same phenomenon (see Box 1). Furthermore, these terms describe the behaviour of one individual, the patient.

Concordance, however, is a much more complex and less clearly defined term relating to the process (e.g. partnership) and outcomes (agreement or shared decision-making) of treatment. Horne et al (2005) suggest it is therefore nonsensical to describe a patient as 'non-concordant' when describing the behaviour of an individual, as the patient does not exist in isolation, but rather it is the patient's relationship and interaction with the clinician that should be defined as concordant/non-concordant.

As treatment emphasis has shifted to a more holistic view, concordance has become preferred over adherence, and the focus is on the factors that might affect the patient's choice to follow a particular treatment regimen. Factors include patients' beliefs, previous treatment experiences, expectations of care, anxiety and coping strategies (Moffatt 2004a and 2004b) (Box 2). Danger arises when concordance is used in a way that implies that attaining concordance will automatically improve adherence.

This process can lead to 'shared' decisions that are not necessarily what the healthcare professional would ideally advise, as it requires the clinician to account for the patient's preferences, which might be at odds with the clinician's views. If the two parties cannot agree a mutually acceptable treatment plan, the result is a non-concordant relationship (Weiss and Britten, 2003). A patient who follows the clinician's advice is classed as adhering to treatment, whereas non-adherence means the patient might reject the advice or treatment offered for many reasons. Within the philosophy of shared decision-making and an understanding of the delineation between adherence and concordance, the clinician must ascertain the reasons for this — by assessing physical, mental, social and cultural wellbeing — and negotiate the treatment plan, accounting for patient-specific factors, to encourage concordance (Wounds International, 2012) (Box 3, p2).

Although concordance might appear a somewhat idealistic concept, it is increasingly necessary with the advent of Patient Reported Outcome Measures (PROMs) (NICE, 2012). These indicators of patient satisfaction with care will be used by Clinical Commissioning Groups to assess care provided. Of course, achieving concordance is not the only factor in ensuring patient adherence, but it is a key method for ensuring that patients feel heard and respected, empowered in their care, and engaged in the treatment process — all of which can help increase quality of life and treatment outcomes.

### Box 3 | Five clinician steps to concordance

According to 'International consensus: Optimising wellbeing in people living with a wound', there are five key steps clinicians should follow to achieve concordance:

1. Asking about overall wellbeing, keeping in mind the patient is a person
2. Prioritising wellbeing when assessing treating and managing a patient's wound
3. Involving patients by offering a genuine choice (i.e. patients have the right to refuse treatment) in treatment options and providing treatment accordingly
4. Using patient feedback to plan/adapt services
5. Collaborating with colleagues, particularly with regard to having strong referral pathways.

Adapted from Wounds International, 2012

### Box 4 | Assessing pain

- Keep in mind that pain can also be the result of arthritis, corns or callouses, fungal foot infection, devitalised tissue in the wound, excess exudate, varicose eczema and hyperkeratosis
- Ask about timing of pain. If it occurs shortly after application of compression, it could be discomfort that stems from adjusting to wearing compression. If it happens near the end of the day, as yet-unresolved oedema may be the cause
- Rest pain could stem from insufficient arterial flow (which contraindicates the use of compression)
- Sustained high pressures at night can cause pain overnight; instead, use inelastic bandaging that provides lower compression pressure when the patient is supine.

## FACTORS THAT AFFECT NON-ADHERENCE AND NON-CONCORDANCE

In relation to venous leg ulceration, there are many reasons a patient might not adhere to compression therapy. Within the literature, studies have found that pain (van Hecke et al, 2008; Mudge et al, 2006; Briggs and Closs, 2006; Moffatt, 2004a and 2004b) and lifestyle factors, such as employment status (Van Hecke et al, 2008; Van Hecke, 2010; Brown, 2013), lack of social support (Charles, 2010) and the inability to wear normal shoes or clothing (Franks et al, 1995; Ebbeskog and Ekman, 2001; Mudge et al, 2006; King, 2007; Heinen et al, 2007; Brown, 2013) could result in non-adherence. Additional factors include restrictions in patient mobility due to bulky bandages (Roaldsen et al, 2006; Davies et al, 2007; Roaldsen et al, 2011) and uncomfortable and ineffective bandaging as a result of poor application techniques (Guest et al, 2013; Partsch, 2013; Brown, 2013).

A patient's initial experience with compression therapy can positively or negatively affect (or might have already affected) his/her subsequent opinion of this form of therapy, increasing the importance of not only applying the right kind and level of compression, but also of discussing options with the patient and making them feel involved. Patients are better engaged with treatment planning and execution when they better understand the rationale behind it. Therefore, provide the patient with information that explains, for example:

- The need to wear compression
- The role of exercises/leg elevation
- Realistic expectations in terms of pain, oedema reduction etc (EWMA, 2008).

In this way, adherence to treatment depends on concordance, which can be influenced by pain levels, lifestyle impact, mobility restrictions and application techniques.

## PATIENT FACTORS

### Pain

Compression therapy can initially increase pain levels (Persoon et al, 2004; Briggs and Closs, 2006; Herber et al, 2007). Briggs and Closs (2006) found that 50% of patients experienced pain on initial application of compression bandaging. Pain levels appear to diminish rapidly if the patient perseveres with treatment and wound healing progresses (Charles, 2004; Briggs and Closs, 2006; Guest et al, 2013).

Pain should be assessed initially using the most appropriate pain scale method for the individual and carefully monitored subsequently with the same pain scale, for better consistency and comparability, so an effective analgesia regimen can be implemented before bandage application and throughout treatment (Box 4). Furthermore, the patient should be instructed to adhere to the analgesia regimen (Johnson 1973). Unfortunately, because it has been found that VLU pain is often underestimated and inadequately addressed (Douglas, 2006), patients often choose to not adhere to compression therapy.

If the patient is experiencing pain, the clinician should undertake a holistic assessment to determine the reason(s) it might be occurring, e.g. poor application of compression, mixed wound aetiology or cellulitis. Further, the clinician should take steps to help control the patient's pain and expectations. For example, if the pain is occurring at rest or at night, changing from four-component bandaging to a two-component inelastic system can ameliorate such pain (see 'Number of components', p7). This is because such a system exerts higher working (standing, ambulating) pressure and lower, more tolerable sub-bandage pressure when the patient is at rest.

Inform the patient that some pain may be expected but that it will decrease as compression therapy is adhered to. If the pain of using compression will prevent adherence, suggest starting with appropriate

application of an alternate compression system (e.g. a hosiery kit), which may be associated with less pain, and gradually increasing compression as tolerance increases. Note that using reduced compression for long periods may delay healing. When applying compression, also ensure sufficient padding for comfort, limb protection and exudate absorption when appropriate (Moffatt, 2004c).

### Lifestyle impact

For many patients, particularly those of working age, wearing bulky bandages such as the four-component system can be unappealing due to the restrictions on choice of shoes and clothing (Mudge, 2006; Heinen et al, 2007; Brown, 2013). The need to purchase wider-fitting shoes might have financial implications, and patients might not be able to adhere to treatment for social reasons (Van Hecke 2010), including:

- Having to wear a specific uniform for work
- Needing to attend regular appointments at specialist clinics during working hours to have compression bandages reapplied (Van Hecke, 2008 and 2010; Brown, 2013).

Given the choice between having a leg ulcer — particularly if the patient perceives it as trivial — and the possibility of unemployment, the patient might make a pragmatic choice of refusing compression therapy (Van Hecke, 2010; Brown, 2013). But less-bulky alternatives, such as hosiery kits and two-component inelastic systems, can help overcome these issues by letting patients wear their usual clothes and shoes while also gaining the benefits of compression.

Although a Cochrane review found that multicomponent systems containing an elastic bandage appear to be more effective than those composed mainly of inelastic constituents (O'Meara et al, 2012), a more recent randomised, controlled trial (RCT) found that "two-layer compression hosiery is a viable alternative to the four-layer bandage — it is equally as effective at healing venous leg ulcers" (Ashby et al, 2013). Another RCT of 156 patients showed that ulcer closure rates for patients treated with a two-component inelastic system were similar to those for patients managed by four-component bandaging (Franks et al, 2004); and researchers behind an observational study of 102 patients found a two-component inelastic system to be well tolerated by and comfortable for patients, safe (low incidence of skin alterations reported) and "with adequate pressure for treating leg ulcers with or without oedema" (Mazzei et al, 2013).

Less-bulky bandages might also be cooler and more comfortable to wear. Discuss lifestyle issues and concerns with patients so that treatment implemented can be fit around daily activities, such as work, to optimise adherence. The reduced bulk of some two-component compression systems allows good ankle mobility and will let the patient wear normal footwear. Mention these benefits to the patient, and offer the choice.

### PHYSICAL FACTORS

There is evidence in the literature that ankle exercises and walking to maximise calf-muscle function might help to heal ulcers (Heinen et al, 2012; Heinen et al, 2007; Roaldsen et al, 2011); however, patients with ulcers have been found to have reduced ankle plantar and dorsiflexion, slower walking speeds and less endurance (Van Uden et al, 2005; Roaldsen et al, 2006; Meagher et al, 2012). Mobility issues are further compounded by the restrictions created by a bulky bandage system (Roaldsen et al, 2006; Davies et al. 2006).

Simple exercises (such as ankle rotation) can be taught to patients who are chair-bound and the patient should be provided with suitable footwear to accommodate compression bandages to encourage mobilisation, where appropriate. Further, offer the patient a choice in the bandage system, with explanations of the clinical benefits and drawbacks of each, to achieve concordance and improve adherence.

## PRACTICAL FACTORS

Effective compression should provide a balance between exerting too little pressure and too much pressure, which can cause damage or not be tolerated by the wearer. Optimal outcomes rest on the provision of consistent levels of compression. However the ability of bandagers to apply bandages can differ, and patients might become anxious when there is inconsistency in their care (Guest et al, 2013; Brown, 2013).

Furthermore, this inconsistency in the application of compression might affect healing rates (Feben, 2003; Guest et al, 2013), as the clinical effect of compression partly depends on the skill of the bandager in achieving the correct amount of sub-bandage pressure and a pressure graduated from toe to knee (Feben 2003). Feben (2003) found that the ability to apply sufficient therapeutic pressures diminished after 2–4 weeks of training, necessitating a programme of ongoing training and competency assessment, which should include guidance on pressure damage, limb distortion, bandage slippage and ineffective pressure levels.

Staff education should also help allay the fears of clinicians who might not apply therapeutic levels of compression because they are afraid of the potential risks. Specialist leg ulcer services can provide training and competency frameworks for nurses working in the community who might not otherwise have access to higher-level compression therapy training (Wounds UK, 2013).

This highlights the need for a compression system that delivers effective therapeutic pressures consistently without the need for ongoing training. For example, a system that locks out to ensure consistent application of compression (e.g. Rosidal TCS, known in the UK as Actico 2C) can standardise practice with minimal training. This lets the application of compression therapy to become the remit of all nurses — not just specialist nurses in leg ulcer clinic settings — and means the nurse with whom the patient is most familiar and comfortable can be the one to apply the bandaging.

From the patient's perspective, consistency of treatment and continuity of care might serve to reassure that therapeutic compression is being applied effectively, thereby reinforcing their confidence in the clinical skills of the clinician, and may help encourage adherence to treatment, as the nurse–patient relationship has been found to be key in promoting adherence to treatment (Moffatt 2004a, Moffatt 2004b, Moffatt et al. 2009; Brown 2013). Furthermore, ensuring continuity of the clinician who applies compression will reinforce the patient's confidence in compression and skills of the clinician.

## CONCLUSION

Although graduated compression is considered to be the most effective therapy for VLU healing, many patients do not adhere to recommended management regimens. Non-concordance with this treatment has been shown to range from 2% to 80% of patients (Moffatt et al, 2009). The reasons for this are numerous, but the major patient, physical and practical factors known to contribute to non-adherence are pain, lifestyle impact, mobility and application techniques.

To achieve a concordant relationship, clinicians and patients will need to agree a regimen through a process of shared decision-making (Box 5). By listening to the patients' fears, concerns and health beliefs, the clinician will be able to determine the factors that could create barriers to adherence. The clinician will also be able to better choose therapies for effective symptom control, through either dressings (e.g. for exudate or oedema management) or analgesia (for pain), which can improve quality of life and patient tolerance of compression therapy (Briggs et al, 2012). Furthermore, concordance in treatment results in better adherence with compression therapy, which increases healing and helps prevent VLU recurrence — which occurs two to 20 times more often when patients are non-concordant (Moffatt et al, 2009). Although the concordant choice may not always reflect the clinician's ideal treatment choice, the greater

### Box 5 | Summary of practical tips for achieving concordance

- Correctly assess the patient's condition and co-morbidities.
- Correctly diagnose and subsequently treat the condition (e.g. using debridement, infection management, skin care) (Hampton, 2005).
- Reassess at 12 weeks to ensure the chosen treatment's effectiveness (SIGN, 2010).
- Discuss the condition and treatment with the patient, taking into consideration the patient's lifestyle, the treatment's mode of action, and expected experience and timelines (Robinson, 2004), as progress towards healing can motivate patients.
- Involve the patient and, if needed, his or her carer(s) in the patient's foot exercises, such as the foot pump (Lindsay, 2005) or toe-curling (Broderick, 2010).
- Use a cohesive outer layer to minimise slippage and improve patient confidence (Moffatt, 2004c).
- Do not abandon proven therapies without investigating the cause of pain (Hopkins and Warbuoys, 2005), keeping in mind that even low-compression bandaging might not be well-tolerated by patients at night.



goals are finding solutions that meet the patient's lifestyle and needs, building trust so patients continue with treatment, and moving towards the ideal over the course of the process. By recognising and acknowledging these factors, offering a choice of treatment options and, ultimately, respecting the patient's choices, a concordant relationship can be achieved.

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# KEY FEATURES AND INNOVATIONS IN COMPRESSION SYSTEMS

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## WHY DO WE NEED COMPRESSION THERAPY?

Venous ulceration is caused when the valves in the deep and superficial veins are compromised and the calf muscle pump is inefficient in facilitating blood flow to the heart; if unmanaged, hypertension increases in the lower limb due to prolonged and worsening venous stasis. The increase in venous pressure alters healthy microcirculation and causes small areas of ischaemia (Wounds International, 2013), leading to tissue necrosis and ulceration. Sixty to 80% of leg ulceration has a venous element, and 10–20% of leg ulcers involve an arterial component (Wounds International, 2013), although the figure for arterial involvement could be higher if specialist diagnostics were used more often.

Compression is the cornerstone of venous leg ulcer (VLU) treatment (SIGN, 2010). Compression garments or bandages, applied externally to the lower leg, increase pressure on the skin and underlying structures, improving venous return and helping relieve the symptoms in the lower limb such as oedema (Wounds International, 2013).

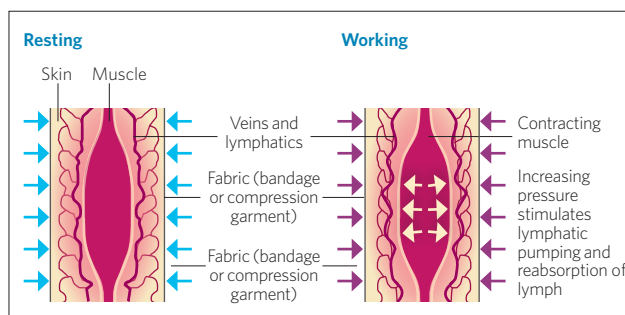
However, a large assortment of compression therapy systems are available, including flat or round knit compression hosiery and individual bandages; two- or four-component bandage systems; and adjustable hosiery. In short, not all bandage systems are the same. Nor are all patients. The individual's circumstances and wound characteristics will also affect compression therapy system choice, which should be decided between clinician and patient. For example, what one patient finds comfortable (which promotes adherence with treatment and, in turn, healing), another will find too painful for use (which can decrease adherence and, therefore, healing), and factors such as this will affect concordance with and adherence to treatment — and, ultimately, healing.

Selecting a compression therapy system rests largely on three factors:

- The bandage's properties (stiffness, pressures, cohesiveness, elasticity)
- The number of bandage components
- The patient's wound status, lifestyle and psychosocial issues.

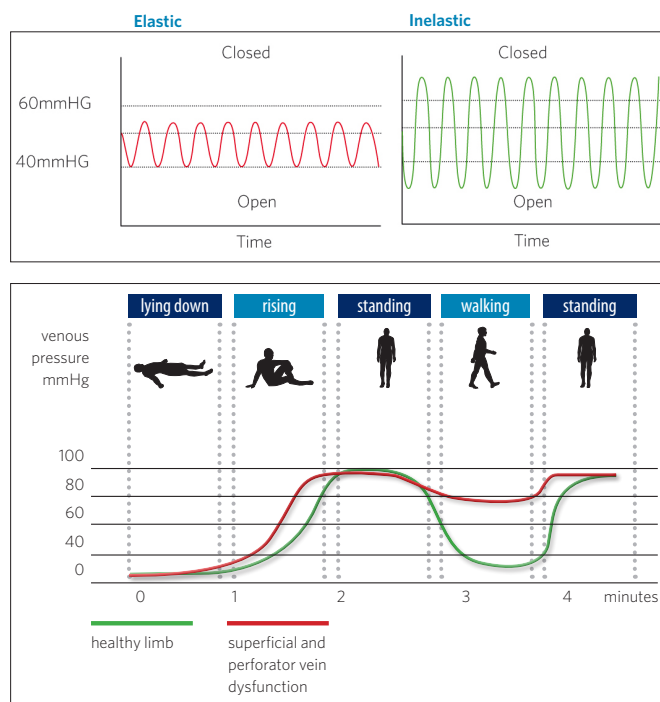
## BANDAGE PROPERTIES

To be effective, external pressure exerted by the compression bandage must be capable of exceeding the internal vein pressure to mimic valve function and promote venous return (Figure 1). Most multilayer compression systems will exhibit some degree of extensibility or elasticity during application; once applied, the difference in pressure created when the patient is active and at rest will depend on the stiffness of the bandage or garment (Mosti, 2013; Wounds UK, 2012). Partsch (2005) developed a method to measure stiffness after application called the Static Stiffness Index (SSI), which scores the increase in sub-bandage pressure exerted when moving from a resting supine position to an active or standing pose (Figure 2, p7).



**Figure 1:** When resting, an external pressure of 20mmHg is required to narrow the veins and promote venous return. However, when standing, the internal hydrostatic pressure in the lower limb rises to 70–80mmHg. In the patient with venous disease, the pressure decreases very little within the veins when standing or walking, resulting in venous hypertension (Mosti, 2010)





**Figure 2:** The Static Stiffness Index can be established by subtracting the supine sub-bandage pressure from standing pressure, with a result of 10mmHg or greater considered inelastic (Mosti, 2013)

**Figure 3:** During walking, the repeat contraction and relaxation of the calf muscle creates a staccato rhythm of high and low compression, which simulates normal valve function in the veins, that is absent in patients with venous disease and is referred to as having a 'massaging effect' (Mosti, 2013)

Because elastic bandages provide sub-bandage pressure differences of less than 10mmHg (Mosti, 2013), it is necessary to apply these systems at high levels of compression. Although this might be tolerated when active or standing, as internal leg pressure resists the compression, the continued squeezing effect during rest is often reported as painful and not suitable for more vulnerable patients, especially those with arterial insufficiency. Using elastic compression can also lead more easily to incorrect application, because staff fail to/are afraid to apply the bandage components at the required high compression levels.

Conversely, an inelastic bandage (e.g. Rosidal TCS) resists the calf muscle's expansion during activity, increases the sub-bandage pressure by greater than 10mmHg and redirects force generated by the muscle back into the leg. When at rest, the force applied is low, making it more comfortable, especially in patients with compromised venous and arterial supply (Figure 3). See Table 1 (p8) for an overview of the evidence and thinking on the use of inelastic bandaging.

### NUMBER OF COMPONENTS

A World Union of Wound Healing Societies (WUWHS) consensus proposed replacing compression 'layer' with 'component' (2008). The change aims to dispel the notion that the number of layers affects the compression level and to enhance precision: a single-layer bandage cannot exist, as there will always be some overlap in the way components are applied (e.g. two components can overlap, forming three or even four layers) (WUWHS, 2008).

#### *Four-component kits*

Exact measurement of compression applied by four-component systems is impractical outside a study setting, as variance occurs based on fabric selected, experience of the clinician, shape of leg and strength of application; some products include visual guides such as rectangles or hemispheres that become squares or circles when a predetermined compression is achieved. However, disparity in compression level achieved remains high, and clinicians commonly omit a component with the thinking they can 'achieve reduced compression', rather than applying a

**Table 1 | Summary of evidence: Use of inelastic bandages**

There is strong evidence accumulating in the literature around the use of inelastic bandages, focusing on the properties exhibited by Rosidal TCS, a two-component compression kit from Lohmann & Rauscher (L&R). A small sample is summarised in the table below.

Author	Content summary
Franks et al (2004)	<ul style="list-style-type: none"> <li>Similar ulcer-closure and study-withdrawal rates for patients treated with two-component and four-component bandage systems</li> </ul>
Hopkins and Worboys (2005)	<ul style="list-style-type: none"> <li>Might require more frequent application initially due to intermittent working pressure peaks that aid venous return</li> <li>Useful for patients who have particular problems with pain at night</li> <li>Difficult to apply at excessive pressure (due to application at 100% stretch), so might be easier to teach clinicians to apply</li> <li>Effective at reversing venous hypertension when applied correctly</li> </ul>
WUWHS (2008)	<ul style="list-style-type: none"> <li>Tends to have less decrease in working pressure, 'resulting in a bandage that provides tolerable resting pressures and higher working pressures' than elastic compression</li> </ul>
Mosti (2010)	<ul style="list-style-type: none"> <li>'More effective than elastic material in reducing venous reflux and improving the venous pumping function'</li> <li>Better-tolerated by patients</li> <li>Recommended treatment for ulcers with venous aetiology</li> </ul>
Charles (2012)	<ul style="list-style-type: none"> <li>Effectively reduces oedema quickly (which necessitates frequent reapplication, to ensure full efficacy)</li> </ul>
Mazzei S et al (2012)	<ul style="list-style-type: none"> <li>Static Stiffness Index value retained well after 1 week's wear</li> <li>Tolerable, safe and comfortable, with adequate therapeutic pressure for treating leg ulcers and oedema</li> </ul>
O'Meara et al (2012)	<ul style="list-style-type: none"> <li>Two-component bandage systems appear to perform as well as four-component systems.</li> </ul>
Knowles et al (2013)	<ul style="list-style-type: none"> <li>Clinicians reported ease of use and patients reported excellent comfort and mobility with Rosidal TCS</li> <li>No incidences of concordance occurred in the 16 patients</li> <li>Fifteen of 16 patients healed or improved towards healing with Rosidal TCS</li> </ul>
Mosti (2013)	<ul style="list-style-type: none"> <li>Exert high pressure that reduces or even eliminates venous reflux, and improves venous calf pumping function</li> <li>Remains comfortable during rest and effectiveness upon resuming ambulation</li> </ul>
Collarte et al (2013)	<ul style="list-style-type: none"> <li>Found Rosidal TCS to be effective, with 2 patients healed in 6 weeks and 2 in 12 weeks. 1 achieved &gt;50% healing in 6 weeks; 1 transferred to hosiery in 2 weeks. 2 were moving towards healing with ongoing care; 7 improved and continued with Rosidal TCS</li> <li>All patients found Rosidal TCS very comfortable</li> <li>No concordance-related issues</li> </ul>

system that achieves the appropriate compression level (Moffatt, 2005). Compression variance is exacerbated by the use of alternative systems for which application skills may vary.

*Two-component kits*

Two-component systems apply compression using only one additional bandage. Systems may include either an elastic (not applied at full stretch) or inelastic bandage component; it is therefore important to check manufacturer information before application. An inelastic bandage is anchored with little pressure around the foot and ankle, then at full stretch from ankle to knee, a technique that may be simpler and more clearly repeatable. As such, inelastic two-component systems are designed to be applied at full stretch; consistency of compression level does not depend on clinician skill or strength, or subjective 'feel' of compression based on bandage extension.

Not all two-component bandage systems are the same, however. SSI testing of Rosidal TCS showed the system exhibits good SSI (Mazzei et al, 2013); there are no figures for other currently

### Box 1 | Clinical benefits and considerations of Rosidal TCS

How the features of Rosidal TCS encourage good clinical practice:

- **Ease of application**  
Application of Rosidal TCS at full stretch with standard spiral technique eases application compared to more complex systems or those with more components. In a recent study, nurses reported the kit as easy to use, effective and suitable for VLU leg ulcers with/without mild uncomplicated oedema and mixed-aetiology ulcers (Collarte et al, 2013).
- **Training**  
Training in a standard, streamlined application technique encourages consistency of compression. With only two components, both applied at 50% overlap, clinicians need little training to ensure Rosidal TCS is applied consistently and correctly.
- **Treatment choice**  
Kits containing the exact components needed to apply compression make choosing the right compression treatment easier, and help eliminate variance in application practice. Rosidal TCS' two components, designed to work specifically together, are packaged together for convenience and consistency of choice.
- **Gaining concordance**  
All patients in a recent study reported Rosidal TCS as 'very comfortable' and had no issues with concordance over the 6-week study period (Collarte et al, 2013).

available systems. Further, Rosidal TCS cannot overcompress due to the Safe-Loc system® (Knowles et al, 2013). Compression consistency is encouraged by the simplicity of two-component systems: with only one component of compression applied in one form (spiral or figure-eight), clinician error and application time are reduced.

Furthermore, inelastic bandages are generally more comfortable/tolerable when the patient is at rest, as two-component kits reduce sub-bandage pressure when the patient is seated or supine. Two-component kits are also less bulky than the four-component systems, so patients often find the system more suited to wear under clothes and wear with their normal shoes (Box 1).

However, as compression reduces oedema, an inelastic bandage will not shrink and will, therefore, apply less compression and could slip as limb circumference reduces. This is solved by scheduling more-frequent applications until oedema levels stabilise. Some systems are suitable for weekly applications once oedema has settled.

### PATIENT CONSIDERATIONS

For any compression therapy to be effective, the patient's needs must be considered and addressed as part of care. Patients might express concerns about the bulk of four-component systems (which can hinder their ability to wear their usual clothing or shoes), or might find them too warm, for example. An inelastic, two-component system such as Rosidal TCS (Box 2, p10) may address the factors that can negatively affect patient concordance with and, ultimately, adherence to treatment. With only two components — including a first component composed partly of a breathable cotton — the kit is not as warm as those with more components as alternative systems and exhibits a surprisingly low profile (Knowles et al, 2013).

Less bulk can mean patients need not alter the way they dress. In a recent case study evaluation of Rosidal TCS (Knowles et al, 2013), patients reported they were able to easily wear their usual clothing and shoes, and that doing so was much more comfortable than with four-component systems they had previously experienced. All patients in the case study described the application and wearing of Rosidal TCS as 'very comfortable' (Knowles et al, 2012). Further, when applied 'toes to nose', Rosidal TCS also allows relatively unhindered movement at the ankle. After 2 weeks' experience with Rosidal TCS, the median rating by 102 patients with VLUs was 'very good' or 'excellent' in terms of quality of life, ease of use, ankle movement and comfort (Mazzei et al, 2013).

Treatment efficacy is also optimised for patients for whom mobility is key. An elastic bandage will apply similar pressure at rest and when active; therefore, when applied at the high tension necessary to provide therapeutic benefit when standing, the leg continues to be squeezed tightly when resting, often causing pain. A patient who is mobile (e.g. able to dress, move around the home aided and unaided, weight-bearing) or is able to conduct simple leg exercises such as ankle dorsiflexion and plantarflexion benefits more from inelastic bandaging than a patient who is immobile (e.g. fixed ankle, limited to no movement), as the massaging effect of high and low pressures during cadence mimic healthy leg vein function (Mosti, 2010; WUWHS, 2008). In addition, inelastic bandages reduce pressure injury risk because high compression is applied only in short bursts when the calf muscle pump is activated, enhancing comfort and lowering resting pressures.

Patients who are comfortable, able to dress as per their usual routines, mobile and seeing results are more likely to feel they are managing their conditions. This feeling of empowerment enhances patient concordance. In the Rosidal TCS case study by Knowles et al (2013), there were no incidences of non-concordance in all of the 16 patients who completed the evaluation. In addition, patients experience an overall positive psychological effect when required to wear only two (rather than four) bandage components (Bennett, 2009).

## Box 2 | Understanding Rosidal TCS

Rosidal TCS, a two-component compression kit from L&R, is designed to make device selection easier for clinicians and to help eliminate variance in application practice that can be present with four-component systems:

- **Primary component**  
Foam bandage with a cotton coating, which complements use of emollients to improve comfort and reduce skin irritation, while eliminating the need for a pre-compression component of cotton tubular bandage commonly used with other compression approaches
- **Compression component**  
Cohesive, inelastic bandage that forms a semi-rigid shell around the calf that does not expand as the calf does. Therefore, the bandage doesn't waste force on expanding, instead redirecting the pressure into the limb, creating the staccato bursts of high pressure that mimic the normal valve function
- **Consistent application**  
The Rosidal Safe-Loc system ensures the bandages are applied at full stretch and makes applying excess compression very difficult with good bandaging technique. Cohesive fabric 'locks out', decreasing the chance of unravelling and severity of slippage and reducing re-bandaging frequency
- **Indications for use**  
Designed for seven-day use if the wound and oedema are stable enough. Fits ankle circumferences 18–25cm. Contraindicated in the very vulnerable limb, ankle sizes smaller than 18cm and where bony prominences are especially pronounced

It is commonly assumed that patients find frequent bandaging changes to be stressful (making four-component systems a more positive choice), and that four-component systems reduce the risk of further injury due to pressure damage. However, Mosti et al (2012) found that there was no significant benefit to more than two weekly compression-bandaging changes. In addition, four-component systems are no safer than two-component systems: consistency of correct application — which is enhanced by having fewer components — is the key to safety (Chatham, 2013). Two-component systems are also “safer for patients with concurrent [peripheral arterial disease]” than four-component systems (Bjork, 2013).

## CONCLUSION

Inelastic compression systems (e.g. Rosidal TCS) provide therapeutic levels of compression during standing and ambulation, while being more comfortable and safe for mobile patients when they are supine. Even patients with poor mobility can benefit from inelastic bandages with simple foot exercises. The major innovation in the current compression systems market is that of choice. The range of product types, functions and applications vary greatly and let the clinician select, modify and experiment with alternative bandages, hosiery or specialist devices to best meet the requirements of their patients, based on the needs of the individual and requirements of the wound. It is therefore the clinician's responsibility to be aware of the available compression systems and be innovative in device selection to meet the changing demands of their patients over the entire treatment course.

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# IN PRACTICE: IMPLEMENTING A TREATMENT PATHWAY FOR COMPRESSION

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## INTRODUCTION

Although compression therapy has long been anointed the 'gold standard' of venous leg ulcer (VLU) care, (O'Meara, Cullum, Nelson et al, 2007), there is increasing recognition that compression bandages can negatively affect patient quality of life. In some cases, this can lead to issues with concordance with treatment regimens and, therefore, lower adherence and an increased likelihood of chronic, non-healing leg ulcers. Further, evidence is emerging that two-component systems ameliorate these issues, encourage concordance with treatment and provide effective compression therapy for patients with VLUs with certain wound and psychosocial characteristics.

Therefore, when a patient with a VLU and chronic oedema presents, the clinician is faced with addressing three issues in order to ensure effective treatment:

- Assessing the patient, wound and leg status
- Choosing the right compression regimen products
- Developing a treatment plan in concordance with the patient.

Recognising that a one-size-fits-all approach no longer fits practice, this article aims to provide clinicians with a practical guide to selecting the most appropriate compression therapy system for — and, importantly, with — each individual patient (Box 1).

## ASSESSING THE WOUND AND LEG STATUS

All patients must receive a comprehensive, documented assessment that includes Doppler before any treatment regimen is considered (Vowden, 2012; SIGN, 2010), with staff having the ability

### Box 1 | Four-step assessment for successful compression selection in venous leg ulcer management

1. Assess the patient's health status, comorbidities and possible underlying conditions causing ulceration and/or oedema
2. Assess the presence of oedema (to identify correct compression system)
3. Assess the wound status (e.g. size, exudate level)
4. Assess patient lifestyle factors (e.g. self-caring, mobility level)

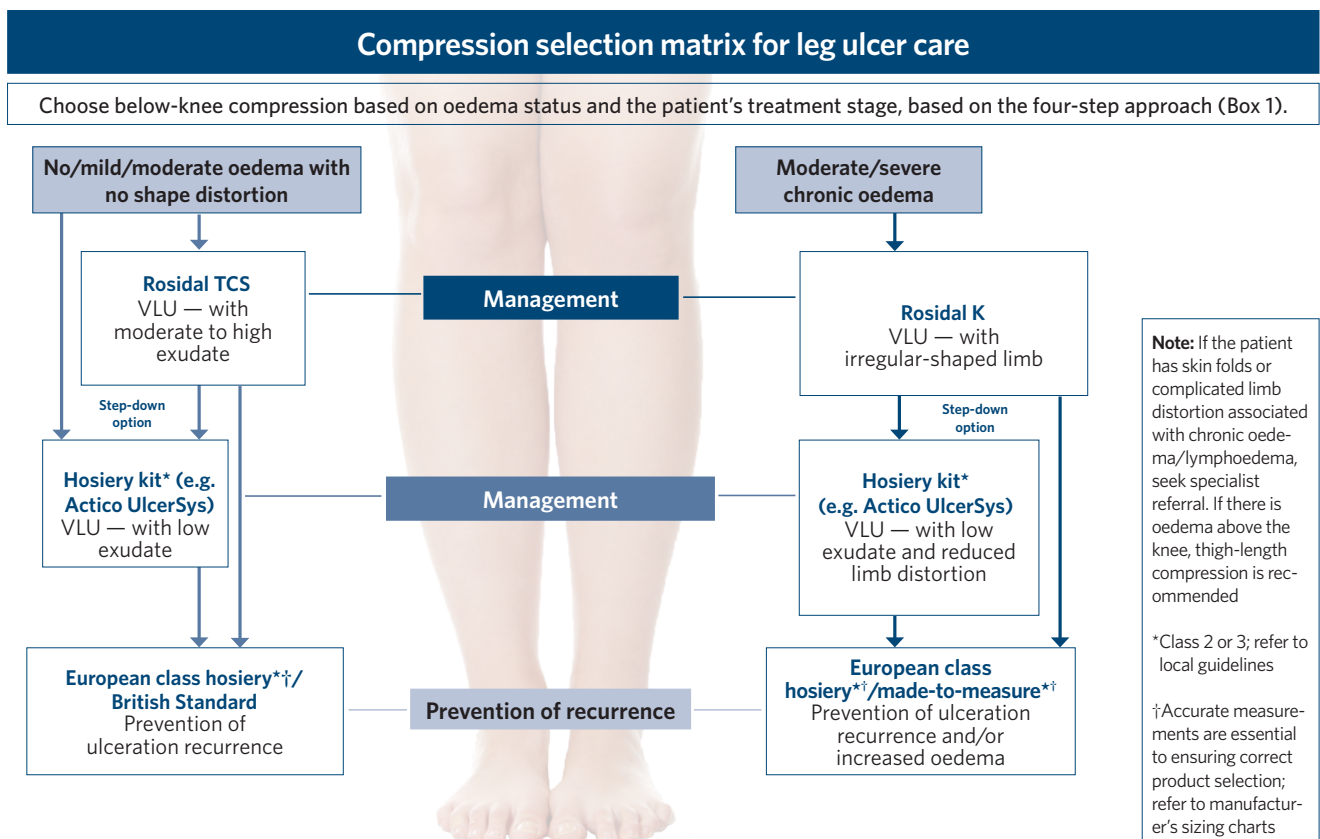


Figure 1: Tool for selecting compression depending on the goals of compression therapy

## Box 2 | Results of VENUS IV

Some of the key findings from the Venous leg Ulcer Study IV (VENUS IV), a randomised, controlled compression study (Ashby et al, 2014)\*:

- **Hosiery a viable alternative**  
Two-component hosiery kits are a viable alternative to four-component compression bandaging for the treatment of venous leg ulcers, achieving equivalent healing rates and lower rates of recurrence
- **Cost-effectiveness**  
Potential savings were seen, as hosiery kits enhance self-care: "Costs in the hosiery group were, on average €339.64 less per year"
- **Patient concordance**  
Hosiery kits were popular with patients, due to being less bulky than four-component bandages and being worn more easily with shoes, which may enhance ankle or leg mobility
- **Patient preparation**  
Using lower-compression systems may prepare patients for maintenance therapy, to reduce the risk of recurrences over the long term

make a differential diagnosis based on the assessment. The next step is to assess for swelling and determine the degree of swelling: mild, moderate (soft or firm) or severe. Assessment should cover limb shape, limb size, how much of the limb is affected, skin condition and the goals of compression.

For example, if the oedema is mild (e.g. the limb is not grossly distorted) in a patient with an uncomplicated VLU where management of both the limb and wound are the goal, Rosidal TCS would be appropriate to add to the selection list. In a limb with a small VLU, minimal exudate and little or no oedema, where the goals are maintenance of the limb and management of the wound, a hosiery kit may also be considered (Figure 1, p11).

### CHOOSING THE RIGHT PRODUCT

The most common cause of lower-limb oedema is venous disease (Moffatt et al, 2003), so it is important to address the underlying cause and to initiate appropriate compression. There are several challenges to choosing and using the right product for the patient.

#### *Educational needs*

Frontline staff cannot be expected to manage VLUs without having received appropriate leg ulcer management education and training. Clinicians should be provided with the necessary tools to treat patients appropriately, including guidelines, protocols and pathways covering a range of clinical competencies (RCN, 2006; SIGN, 2010). However, teams in areas with high staff turnover often struggle on a daily basis to meet the service demands, meaning that allowing staff the luxury of time to attend training can prove difficult or even impossible. Application of four-component compression requires high skill levels as, in the wrong hands, such systems have the potential to cause pain and pressure damage. A lack of education, then, can result in suboptimal treatment, late patient referral and uncontrolled symptoms for the patient. Two-component systems are also now available, comprising two layers of bandages that are applied in a standardised way, which can relieve some of the demands on staff time. In addition, new research shows that two-component compression hosiery kits are equivalent to four-component compression bandaging systems for leg ulcer healing (Ashby et al, 2014); such kits are easy for clinicians to use and may provide a more concordant option for patients (Box 2).

#### *Range of choice*

There are now numerous compression therapy regimens available to the clinician and the patient among bandage systems and hosiery kits. To make an informed decision, the clinician must be aware of the range of available options and how they fit both VLU and oedema statuses. Providing a selection matrix (Figure 1, p11) of on-hand options to frontline clinicians can help them navigate the product choices.

### DEVELOPING A TREATMENT PLAN IN CONCORDANCE WITH THE PATIENT

A patient's confidence is enhanced when it is clear the clinician has knowledge and confidence about compression systems and is able to offer sound clinical advice. However, Cutting and White (2012) remind clinicians of their responsibility to identify and select clinical interventions that achieve optimal patient outcomes tailored to the circumstances. For example, footwear is of major importance to many patients — it can make the difference between going out or feeling like a prisoner in their own homes. Other patients might not either want to, or feel capable of managing their own dressings.

There are many issues to consider from the patient/carer and the clinician perspectives. Table 1 (p13) provides a discussion aid highlighting some of the factors relevant to each compression system to take into consideration, thereby assisting further in making that informed decision.



Although not exhaustive, it addresses issues that may be of importance to the patient's ability to live a life that is not completely governed by a VLU — and could be used as a conversation starter. Other factors to discuss should include the patient's sleep, diet, psychological and social needs.

Without a dialogue between patient (and his/her carer) and clinician about these issues, some patients might pursue their own 'methods' to manage their VLUs, rather than adhere to a regimen they perceive negatively affects their day-to-day lives. For example, a woman in her 50s

<b>Table 1   Guide to shared decision-making* for compression therapy</b>				
<b>Lifestyle considerations</b>	<b>Rosidal TCS</b>	<b>Hosiery kit</b>	<b>Rosidal K</b>	<b>4-component bandaging system</b>
Footwear: Will I be able to wear my regular shoes?	Yes	Yes	Yes	No
Hygiene: Will I have the flexibility to shower or bathe?	Yes (if patient is able to self-apply)	Yes	No	No
Comfort: Is there a cotton-backed layer against the skin?	Yes	No	Yes (100% cotton)	No
Daily routine: Will I have the ability to self-manage/care?	Yes	Yes	No	No
Cost: Is it reusable?	No	Yes	Yes	No
<b>Clinical considerations</b>				
Allergies/sensitivity: Is it latex-free?	Yes	Some — important to check	Yes	Some — important to check
Sizing: Is it appropriate for ankle circumference less than 18cm?	No	Check manufacturer's sizing chart	Yes (if padding is used)	Yes
Sizing: Is it appropriate for ankle circumference greater than 32cm?	No	Check manufacturer's sizing chart	Yes	Yes
Exudate: Can it be used in conjunction with a primary dressing in instances of low to moderate exudate?	Yes	Yes	Yes	Yes
Exudate: Can it be used in conjunction with a primary dressing in instances of heavy exudate?	Yes	No	Yes	Yes
Training: Is extensive, repeated, ongoing training crucial to correct application?	No	No	Yes (below-knee and full-leg bandaging)	Yes
*Use or modify this table to work through with the patient to establish transparency in the decision-making process and afford the time for discussion and patient involvement.				

who works may well struggle to adhere to a four-component system. However, she might accept a hosiery kit that lets her self-manage. Clinicians have to remember that, although expeditious healing is our goal, the patient has to live with the treatment often for weeks and months, so it is vital that the patient be concordant with the treatment decision.

It is vital to remember that some movement towards healing, even if suboptimal to the clinician, is better than none. Healing is not always the primary outcome; symptom control and being able to cope day-to-day are often more important to a patient. It is also important to stress to the patient that therapy will be regularly re-evaluated with the patient's input, and ulcer healing and exudate reduction may open other compression options.

## CONCLUSION

The government wants shared decision-making to become the norm in the NHS, coining the phrase 'no decision about me without me.' Coulter and Collins (2011) note that nearly all patients want clinicians to listen, explain and answer their questions. Individual consultations may indeed take a little longer, but time spent engaging the patient in the decision may reduce the overall time spent caring for someone who is unsure or unhappy about a decision they were not involved in (Bekker et al, 2004).

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## CASE 1: MODERATE OEDEMA WITH PREVIOUS COMPRESSION NON-CONCORDANCE

### BACKGROUND

Ms G, a 69-year-old female, suffered a road traffic accident in May 2008 that resulted in extensive soft-tissue injuries to her right leg. These wounds failed to heal over the course of 6 years, during most of which time she had been a patient on the district nurse case load. Skin grafting was not successful. The right and left legs had moderate oedema that extended into the thigh, with limb distortion to the right thigh from scarring. The oedema in her right knee had reduced her mobility such that Ms G had to give up driving her car. A light support bandage had been used, and she had been unable to wear shoes of choice due to perpetual bandaging. During this time, Ms G failed to acknowledge the wound was a leg ulcer and disliked the term 'leg ulcer' being used when discussing her care. This resulted in her not being treated appropriately, as the district nurses failed to recognise the oedema and continued to treat the wound as a trauma wound. Ms G came to the tissue viability service after a complaint for inappropriate treatment and failure to heal.

### TREATMENT

On 13 November 2013, treatment was commenced to the right leg, using Rosidal TCS (due to multiple allergies, including non-steroidal anti-inflammatory drugs, latex, pork and elastin, and to previous intolerance of compression bandaging) below the knee only. The patient was later assessed for full-limb compression to reduce oedema in the right thigh to aid reshaping of the limb.

Upon presentation on 6 January 2014 to commence full-limb bandaging of right leg, the wound measured 6.6cm x 4.5cm, with 100% granulation tissue. The right leg measured 22cm at the ankle, 43.5cm at the calf, 46cm at the knee crease and 56cm at the thigh. Assessment revealed no significant arterial disease; there was some hyperkeratosis and varicose eczema. The skin was debrided with a single-use monofilament pad (Debrisoft®, Lohmann & Rauscher) to reduce hyperkeratosis. A topical steroid was applied to address varicose eczema; a knitted viscose primary wound contact layer and super-absorbent secondary dressing (Vliwasorb®, Lohmann & Rauscher) to absorb exudate, along with medical-grade silk heel-less below-knee under socks. Encased foam chippings were used for the first 2 weeks to soften scar tissue. Rosidal TCS (Actico 2C) was applied to the full limb using one large kit; reapplication was scheduled three times the first week, and twice a week thereafter.

**Day 10** The wound measured 6.1cm x 4.5cm (8.6% reduction).

**Day 21** The wound measured 4.2cm x 4.0cm (a further 39% reduction). The left leg measured 24cm at the ankle and 41cm at the calf, and was started on below-knee Rosidal TCS (Actico 2C) to reduce oedema.

**Day 28** The wound measured 4.2cm x 3.5cm (a further 12.5% reduction), and the right leg measured 21cm at the ankle, 38cm at the calf, 43.5 cm at the knee crease and 54cm at the thigh. The leg had reshaped, and oedema had reduced. Reapplication remained twice a week. The left leg measured 21.5cm at the ankle and 37.5cm at the calf; the patient was measured for hosiery.

**Day 39** The wound measured 2.7cm x 2.2cm (overall 80% reduction). Moderate exudate was contained within the primary dressing and reduced over the course of treatment.

**Day 67** The wound measured 1.5cm x 1.3cm (overall 93% reduction). Exudate levels had greatly reduced, and the wound margins had begun to contract.

**Day 101** The wound had healed, with 100% epithelialisation of the wound bed.

### DISCUSSION

The bandage was easy to apply, exhibited no slippage, conformed well to limb shape, reduced limb size and aided limb shaping. Although designed for below-knee use, Rosidal TCS (Actico 2C) was able to conform and reduce thigh oedema, which was beneficial in treating a person with multiple allergies to typical compression system components. Scar tissue softened beneath the bandaging to aid further drainage. Ms G was able to wear her own footwear during treatment. Rosidal TCS (Actico 2C) was the only compression that she had been able to tolerate over years of treatment; she reported experiencing no discomfort, despite the frequency of reapplication. She was happy with the reduction of oedema and the reshaping of the leg, reporting that she felt it "actually looked like a leg again; the bandage works."

*Karen Staines, Honorary Contract Tissue Viability Nurse and Ray Norris, CNS Tissue Viability Nurse, both of North East London NHS Foundation Trust*

North East London   
NHS Foundation Trust



FIGURE 1. Application of two-component inelastic compression



FIGURE 2. Wound after 21 days (3 Feb 2014)

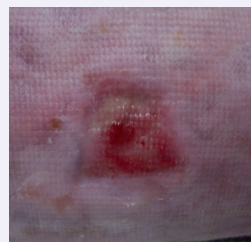


FIGURE 3. Wound after 67 days (14 March 2014)

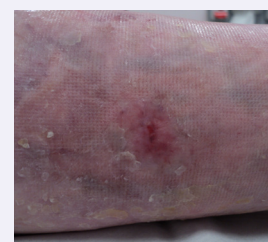


FIGURE 4. Healed wound with 100% epithelialisation (17 April 2014)

# CASE STUDIES

## CASE 2: VENOUS LEG ULCER UNCOMPLICATED BY OEDEMA

### BACKGROUND

A 77-year-old male presented with a venous leg ulcer of about eight weeks' duration on the right leg. He had aortic valve disease and was attending a vascular clinic for treatment. He was also awaiting a transurethral resection of the prostate. He had been treated for 2 weeks with a cohesive inelastic compression bandage system (Rosidal TCS, Lohmann & Rauscher) and a sheet hydrogel wound dressing (Suprasorb® G Gel Wound Dressing/ActiFormCool, Lohmann & Rauscher).

The wound measured 7cm x 5cm, with 100% granulating tissue. There was some hyperkeratosis, which was cleansed with tap water and an emollient and debrided with a single-use monofilament pad (Debrisoft, Lohmann & Rauscher). Chronic oedema was not present. Pain associated with the wound was rated a 4 of 10 on the visual analogue scale (VAS), and there was a high level of exudate.

After assessment, it was determined that the objective of further care should be to prevent breakdown of and heal the wound, while providing compression that would fit under his boots for outdoor work on a farm. Due to overgranulation, the dressing was changed to a silver-containing foam dressing for 2 weeks, and Rosidal TCS (Actico 2C) was initiated, with dressing and compression changes scheduled twice weekly.

### TREATMENT

**Week 1** The VLU measured 7cm x 5cm. Exudate had reduced to a moderate level. He also presented at this time with another, non-venous ulcer, on the left leg, which measured 2cm x 1cm. This wound was treated with a simple contact layer. The compression regimen was continued on the right leg, with changes scheduled twice weekly. Pain associated with the wound was reported as 3 on the VAS.

**Week 3** The wound on the right leg measured 5cm x 2.5cm, a 64% reduction, and its exudate level was low. The dressing and compression regimens were continued, with changes scheduled weekly. Pain associated with the wound was reported as 1 on the VAS. The non-venous ulcer on the left leg had healed.

**Week 6** The VLU had healed. Treatment was changed to a leg ulcer hosiery kit for 2-3 weeks.

### DISCUSSION

After the leg ulcer hosiery kit, the patient's maintenance treatment was changed to British Standard hosiery. He had no oedema, the wound had not recurred, and he has continued to attend clinic for regular check-ups.

Rosidal TCS (Actico 2C) was found to be easier to apply than the previous bandaging system, and the clinician was pleased by the rapid healing achieved. The patient reported that Rosidal TCS (Actico 2C) was very comfortable, not as warm and irritating as the previous bandaging system, and that he was happy he could wear normal shoes and his wellington boots, which let him continue with his typical daily activities.

*Paula Shanks, Senior Community Staff Nurse and Team Leader  
'Legs 11' Leg Ulcer Clinic, Newport Pagnell*



FIGURE 1. Due to overgranulation, a silver-containing foam dressing was initiated, along with Rosidal TCS (Actico 2C); dressing and compression changes were scheduled for weekly



FIGURE 2. The wound on the right leg measured 5cm x 2.5cm, a 64% reduction



FIGURE 3. The wound continued to progress towards healing



## A PATIENT'S STORY: SAVING THE REMAINING LEG

When 78-year-old Albert\*, presented at the Barnstaple Leg Club, he expressed that nothing was more important to him than saving his remaining leg. Many years prior, he had suffered an accident on board a ship while in the Royal Navy and underwent amputation of the left leg below the knee as a result.

In 2009, he came to his local Leg Club for treatment of the right leg, the skin of which had become red and raw and exuding. Nurses identified management of exudate and care of the skin as priorities. Because the ulcer was venous in origin (ankle-brachial pressure index reading was 0.97), compression was agreed as appropriate treatment. Due to his reluctance to have full compression, he was initially begun on reduced, three-component compression.

About this time, Rosidal TCS (Actico 2C) was being evaluated within the Leg Club. Nurses had reported they found learning application of Rosidal TCS (Actico 2C) to be quick and easy, and that the system itself to be very conformable and secure once in place. Albert was asked if he would like to try the new system. Encouraged by very positive feedback from other members, including comments such as "This is the nearest I have come to not wearing a bandage," compression with Rosidal TCS (Actico 2C) was initiated.

Albert immediately commented on how comfortable and light he found the compression system. One of his overall priorities throughout treatment has been his ability to exercise and, upon return for re-bandaging, he said that the new system was 'wonderful', as it was flexible and he did not feel at all restricted in it.

After a few months on Rosidal TCS (Actico 2C) and steady improvement in the wound and skin statuses, Albert was transitioned to hosiery. However, the leg and wound again broke down.

The decision has since been made between Albert and the Leg Club to use Rosidal TCS (Actico 2C) for maintenance, partly because the results he experienced with the system made him feel secure that he would be able to keep his leg. He also reported that, on an ongoing basis, he was pain-free with Rosidal TCS (Actico 2C) and that the bandaging stayed in place each week, even with regular exercise. In addition, Albert is under the care of the local vascular team, which has reported positive assessment of the bandaging kit and the leg's improvement.

*Megan Mew, Leg Club Lead, Barnstaple,  
Northern Devon Healthcare Trust*

\*Name changed to protect patient privacy



FIGURE 1. Albert after initiation of Rosidal TCS (Actico 2C) for compression. Saving the remaining leg was his key priority



FIGURE 2. With the use of Rosidal TCS (Actico 2C), Albert's wound healed. He continues to use the compression system for maintenance of the leg

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## Trust Your Strength.

- Safe-Loc system: absolutely simple application without pressure indicators – safe application at full stretch
- padding compression bandage with integrated skin protection – for high wearing comfort
- cohesive compression bandage – adheres to itself and reduces the risk of slipping due to its high degree of stiffness
- thin and supple – fits easily into shoes

