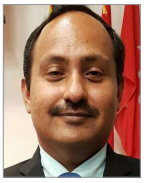
A new two-layer compression system for managing chronic venous leg ulcers



In 2013, the annual NHS cost of managing wounds was comparable with the annual NHS cost of managing obesity, which was estimated at £5 billion. Chronic or hard-to-heal wounds in general practice are classified based on type, but acute wounds such as abscesses, burns and traumas that do not heal within four weeks can also be classified as chronic wounds. The aim of this study was to evaluate a new two-layer compression system on venous leg ulcers (VLU) due to chronic venous insufficiency.

Authors (clockwise from the top left):
Harikrishna K. R. Nair,
Sylvia SY Chong,
NorSyazwana Binti Abdul Razak

A wound is defined as a breakdown in the protective function of the skin; the loss of continuity of epithelium, with or without loss of underlying connective tissue, i.e. muscle, bone, nerves (Leaper and Harding, 1998), following an injury to the skin or underlying tissues/organs. This may be caused by surgery, a blow, a cut, chemicals, heat/cold, friction/force, or as a result of diseases such as leg ulcers or carcinomas (Hutchinson, 1992). Wounds can heal by primary or secondary intention depending on whether they can be closed with sutures or left to repair, whereby damaged tissue is restored by the formation of connective tissue and re-growth of epithelium (Cooper, 2005).

Real-world evidence has highlighted the massive burden of managing acute and chronic wounds for decades, and this was further aggravated by high inflation rates, rising longevity and increasing comorbidities. In 2013, the annual NHS cost of managing wounds (Guest et al, 2015) was comparable to that of managing obesity (Royal College of Physicians, 2013), which was estimated at £5 billion.

In the UK, an average clinical commissioning group (CGC)/health board was estimated to be managing 11,200 wounds in 2012/2013. Of these, 48% were chronic wounds and it was determined that only 43% healed and the prevalence was rising by approximately 12% per annum. Analysis by Guest et al in 2015 indicated that the current rate of wound healing must increase by an average of at least 1% per year across all wound types in order to slow down the increasing prevalence. Otherwise, an average CCG/health board is predicted to manage ~23,200 wounds per annum by 2019/2020 and to spend £50 million on managing these wounds and associated comorbidities (Guest et al, 2017).

Chronic wounds in general practice are classified based on type, such as diabetic foot ulcers (DFU), venous leg ulcers (VLU) and pressure ulcers (PU). However, acute wounds such as abscesses, burns and traumas that do not heal within four weeks can also be classified as chronic wounds (Guest et al, 2015). Chronic wound management relies on the delivery of standardised care and this is based on a reliable diagnosis and treatment of the underlying cause.

Leg ulcers can occur due to multiple aetiologies such as chronic venous insufficiency, arterial disease, mixed diabetes, lymphoedema, trauma and malignancy. In this study we focused on VLUs due to chronic venous insufficiency. These are the most common leg ulcers. The lifetime prevalence of VLUs in the total Western population is 1% and it can rise to 3–4% in people over

Harikrishna KR Nair *is Head of Wound Care Unit, Department of Internal Medicine, Hospital Kuala Lumpur;*
Sylvia SY Chong *is a Research Assistant, Wound Care Unit, Department of Internal;*
NorSyazwana Binti Abdul Razak *is a Research Assistant Wound Care Unit, Dept. of Internal Medicine Hospital Kuala Lumpur*

65 (Ratliff et al, 2016). The annual incidence of VLUs of adults within the UK is 0.59% (approximately 278,000 patients per annum) (Guest et al, 2015).

Good wound care and compression therapy will accelerate the healing process of most small ulcers in a short duration (Phillips, 2001). Compression therapy is the gold standard treatment for VLUs, as stated by Partsch and Mortimer (2015). It is designed to overcome venous insufficiency by providing an external force that works in tandem with the body's natural pump functions, such as the contraction and relaxation of the calf muscle, which promotes venous return. As reported by Brem et al (2004), compression restores valve competence and reduces ambulatory venous pressure, therefore reducing venous reflux. As Abu-Own et al (1994) have shown, the main goals of compression therapy include wound healing, reducing pain and oedema and preventing recurrence. Compression therapy also helps decrease inflammatory cytokines, accelerates capillary flow and lowers capillary fluid leakage, thereby alleviating limb oedema. It also improves lymphatic flow and function, softens lipodermasclerosis and enhances fibrinolysis.

Compression bandaging systems that are available in the market vary from single, double and four-layered. The 2012 Cochrane Review (O'Meara et al, 2012) that included 48 random control trials, demonstrated the effectiveness of different compression systems on VLU healing and concluded that a four-layer bandaging system is the gold standard. The four-layered compression bandaging system comprises of orthopaedic wool, crepe bandage, elastic bandage and a cohesive retaining layer. Although the methodological quality of the evidence is variable, there is overwhelming evidence that multilayer high compression systems greatly increase the chances of healing. A more recent review and update of the evidence by Nelson and Adderley (2016) came to the same conclusion. Similarly, although there is very little evidence on the use of compression to prevent recurrence of VLUs, the overwhelming evidence of effectiveness for healing makes it highly likely that compression is effective at preventing recurrence, as shown by Nelson and Bell-Syer (2014).

However, a study by Lazareth et al (2012) noted that the two-layered system was equally effective in managing VLUs, compared with the four-layered system. A two-layered system is also easier to apply and relatively cheaper. The two-layered compression bandaging system comprises of soft foam padding and a cohesive elastic compression bandage. Currently, two-layered systems are used for active mobile patients while the four-layered systems are used for non-mobile patients. Short-stretch bandages are commonly used in tropical countries due to the humid weather. A randomised controlled trial reported by Moody (1999) of 52 patients with VLUs noted that there was a more significant reduction in wound size when comparing short-stretch with long-stretch bandages.

Objective

To evaluate a new two-layer compression system on chronic VLUs.

Methodology

Wounds were assessed using the TIME-Clinical Decision Support Tool concept (Blackburn et al, 2019), and the ankle-brachial pressure index (ABPI) was measured with a blood pressure cuff and a Doppler unit. The compression bandage system was contraindicated in patients with ABPI<0.5, arterial conditions (arterial or predominantly arterial ulcers; known or suspected arterial disease), diabetic angiopathy, ischaemic phlebitis, septic thrombosis and those who were latex intolerant. On each patient, the wound was initially cleaned using distilled water and debridement was performed where necessary. The wound was then covered with polyurethane foam (Espuma foam, Pharmaplast) and a crepe bandage.

A two-layer compression bandage was applied to all patients. The foot was positioned at 90º, before securing the soft foam bandage by wrapping it twice around

Table 1. Quick guide to compression

ABPI	Compression level		Cohesive compression bandage
For 0.5 < ABPI < 0.8	25–30 mmHg	Light	Stretch bandage before full circle
ABPI > 0.8	35–40 mmHg	Standard	Full-stretch bandage to oval shape

Table 2. Summary of patient data

Case	Age/gender	Comorbidities	Initial wound size (cm)	Final wound size (cm)
1	52/female	Hypertension	6.0 x 8.0 5.0 x 4.0	3.0 x 2.0 0.5 x 1.0
2	54/female	Diabetes mellitus (type 1or 2) Hypertension	4.0 x 3.0	0.8 x 0.8
3	60/male	Hypertension Eczema	12.0 x 7.0	re-epithelisalisation
4	51/male	Hypertension	(R) 5.0 x 10.0 (L) 9.0 x 7.0	R) 2.5 x 1.0 (L) 5.0 x 4.0
5	52/female	Diabetes mellitus (type 1or 2)	6.0 x 8.0	2.0 x 3.0
6	67/male	none	11.0 x 7.0	6.0 x 6.0

Case 1

29th April 2020	20th July 2020
Size: 6.0cm x 8.0cm Size: 5.0cm x 4.0cm	Size: 3.0cm x 2.0cm Size: 0.5cm x 1.0cm
	

the forefoot. It was then passed above the ankle and back down to cover the heel (figure of 8/Sigg Technique). It was wrapped up the leg with minimal overlap, stopped approximately 1 inch below the knee. The excess soft foam bandage was then cut and removed, and the bandage was secured with adhesive tape. Depending on the ABPI value measured, the compression was applied as listed in ***Table 1***.

Applying at stretch/full-stretch, the cohesive compression bandage was wrapped twice around the forefoot. It was then passed above the ankle and back down to cover the heel. It was wrapped up the leg with 50% overlap while maintaining stretch/full-stretch, stopped approximately 1 inch below the knee. The excess cohesive compression bandage was cut and removed, and the entire bandage was gently compressed using both hands.

Results

We randomly selected six patients with VLUs from a wound clinic ***(Cases 1–6)***. The patients were aged between 51 and 67 and all showed more than a 50% reduction in wound size over 12 weeks ***(Table 2)***.

Case 1

The patient was a 52-year-old Indian female with underlying hypertension for more than 10 years. They claimed that the wound developed following an insect bite.

Case 2

The patient was a 54-year-old Malay female with underlying type-2 diabetes and hypertension. The patient had a history of bilateral lower limb ulcer for more than 20 years.

Case 3
The patient was a 60-year-old Malay male with underlying hypertension. They had a history of chronic eczema, with a chronic left ulcer.

Case 4
The patient was a 51-year-old Chinese male with underlying hypertension. They had a history of chronic venous ulcers for the past four years.

Case 5
The patient was a 52-year-old Indian female with underlying type 2 diabetes. They were referred from dermatology.

Case 6
The patient was a 67-year-old Chinese male with no known medical illness. They had a history of chronic venous insufficiency for more than five years.

Discussion
The two-layered compression system was more suitable in this study (Nair, 2019), largely due to the hot and humid weather in tropical countries. In an observational study of general assessment on 102 patients, multiple factors improved when a two-layered compression system was used. 13 patients from the study group complained about slippage, rolling, loss

Case 2

16th April 2020	29th May 2020
Size: 4.0cm x 3.0cm	Size: 0.8cm x 0.8cm
	

Case 3

18th May 2020	14th July 2020
Size: 12.0cm x 7.0cm	Re-epithelialisation
	

Case 4

16th April 2020	9th July 2020
Size: 5.0cm x 10.0cm	Size: 2.5cm x 1.0cm
	
Size: 9.0cm x 7.0cm	Size: 5.0cm x 4.0cm
	

Case 5

4th May 2020	9th July 2020
Size: 6.0cm x 8.0cm	Size: 2.0cm x 3.0cm
	

Case 6

27th April 2020	22nd July 2020
Size: 11.0cm x 7.0cm	Size: 6.0cm x 6.0cm
	

of sensitivity, feeling of tightness, heat, itching and exudate in the bandage, but despite this, the median rating by the 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).

The two-layered compression bandage system used for this study was DEFLATE. The first layer is a soft foam bandage that has an excellent moisture transfer rate. It is non-slippery and has itch control properties. The second layer is a cohesive elastic bandage that is breathable and lightweight, hypoallergenic, and has self-adhesive and high cohesiveness features. The self-adhesive bandage includes visual indicators that can control compression levels according to stretch forces.

Conclusion

As reported in the Malaysian Ministry of Health's 2014 manual of wound care, the main treatment for chronic venous insufficiency with VLUs is compression bandaging. This is the standard of care in the Wound Care Unit at the Kuala Lumpur Hospital. Two-layer bandaging is effective, especially in Malaysia, and compliance is also better among the patients, which is crucial for the healing of VLUs. The limitation in this study is that only 6 cases were chosen, and this number is a small sample size compared with the population. WAS

Declaration of interest:
HS Healing Solution Limited sponsored the DEFLATE Compression Bandage System used for this study. The author has no conflicts of interest to declare.

References

Abu-Own A, Scurr JH, Coleridge Smith PD (1994) Effect of leg elevation on the skin microcirculation in chronic venous insufficiency. *J Vasc Surg* 20:705–10. https://doi.org/10.1016/s0741-5214(94)70157-1

Blackburn J, Ousey K, Stephenson J (2019) Using the new T.I.M.E. Clinical Decision Support Tool to promote consistent holistic wound management and eliminate variation in practice: Part 5, survey feedback from non-specialists. *Wounds International*10(4):40–49

Brem H, Kirsner RS, Falanga V (2004) Protocol for the successful treatment of venous ulcers. *Am J Surg* 188:1–8. https://doi.org/10.1016/s0002-9610(03)00284-8

Cooper P (2005) A review of different wound types and their principles of management in wound healing: A systematic approach to advanced wound healing and management. Cromwell Press

Guest JF, Ayoub N, McIlwraith T et al (2015) Health economic burden that wounds impose on the National Health Service in the UK. *BMJ Open* 5:e009283. http://dx.doi.org/10.1136/bmjopen-2015-009283

Guest, JF, Vowden K, Vowden P (2017) The health economic burden that acute and chronic wounds impose on an average clinical commissioning group/health board in the UK. *J Wound Care* 26(6): 292–303. https://doi.org/10.12968/jowc.2017.26.6.292

Hutchinson J (1992) The Wound Programme. Centre for Medical Education: Dundee

Lazareth I, Moffatt C, Dissemond J et al (2012) Efficacy of two compression systems in the management of VLUs: results of a European RCT. *J Wound Care* 21(11):553–565. https://doi.org/10.12968/jowc.2012.21.11.553

Leaper DJ, Harding KG (1998) Wounds: Biology and management. Oxford University Press

Malaysia: Ministry of Health (2014) Manual of Wound Care (4th edn). https://tinyurl.com/y22jyvwp (accessed 18 January 2021)

Mazzei S, Mosti G, Collarte A et al (2013) Results of an observation study in 102 leg ulcer patients with new two-component-system (TCS). Poster presented at: European Wound Management Association Conference, Copenhagen, Denmark: 15–17 May

Moody M (1999) Comparison of Rosidal K and SurePress in the treatment of venous leg ulcers. *Br J Nurs* 8:345–355

Nair HKR (2019) The use of compression to treat venous leg ulcers: The inadequacy of current compression systems especially in tropical nations. In: Mani R, Rerkasem K, Nair H, Shukla V (eds), Compression and Chronic Wound Management. Springer

Nelson EA, Adderley U (2016) Venous leg ulcers. *BMJ Clin Evid* 2016:1902

Nelson EA, Bell-Syer SEM (2014) Compression for preventing recurrence of venous ulcers. *Cochrane Database Syst Rev* 9:CD002303. https://doi.org/10.1002/14651858.cd002303.pub3

O'Meara S, Cullum N, Nelson EA, Dumville JC (2012) Compression for venous leg ulcers. *Cochrane Database Syst Rev* 11:CD000265. https://doi.org/10.1002/14651858.cd000265.pub3

Partsch H, Mortimer P (2015) Compression for leg wounds. *Br J Dermatol* 173(2):359–69. https://doi.org/10.1111/bjd.13851

Phillips TJ (2001) Current approaches to venous ulcers and compression. *Dermatol Surg* 27(7):611–21. https://doi.org/10.1046/j.1524-4725.2001.00195.x

Ratliff, CR, Yates S, McNichol L, Gray M (2016) Compression for primary prevention, treatment, and prevention of recurrence of venous leg ulcers: An evidence-and consensus-based algorithm for care across the continuum. *J Wound Ostomy Continence Nurs* 43(4):347–364, https://doi.org/10.1097/won.0000000000000242

Royal College of Physicians (2013) Action on obesity: Comprehensive care for all. Report of a working party January 2013. https://tinyurl.com/y3upyyjy (accessed 18 January 2021)