Pushing the boundaries: The effect of a superabsorber when used in conjunction with a four-layer compression system

Bruwer FA, BCur (UP), MSocSci (Cum Laude) (UFS), Cert Wound Care (UFS), IIWCC (Toronto/US), Cert Wound Care (Hertfordshire)
Nurse Specialist: Wound Care South Africa
Correspondence to: febebruwer@gmail.com
Keywords: superabsorber, venous leg ulcer, interface pressure
Declaration: BSN Medical™ (an Essity company) sponsored the study and supplied all the products

Abstract

Objectives: The aim of this study was to measure the interface pressure of a super-absorber (Cutimed Sorbion™, BSN) used in conjunction with a multilayer compression bandage (Jobst Comprifore™, BSN) to establish if an increase in interface pressure has a detrimental effect on wound healing.
Methods: Interface pressure was measured on the distal leg of 20 volunteers, with the superabsorber and with a multilayer compression bandage.
Results: A mean increase of 5,3 mmHg in interface pressure from day 0 to day 7. With all the patients the interface pressure remained within a range of 40 mmHg to 60 mmHg.
Conclusions: Although interface pressure increased, there was a noticeable decrease in leg circumference and reduction in oedema, as well as a decrease in wound size.

Republished with permission: *Wound Healing Southern Africa 2018;11(1):12-16* Prof Nurs Today 2018;22(4):10-14

Introduction

Chronic wounds, specifically lower leg ulcers of venous aetiology, are often complex, hard to heal and place a significant socio-economic burden on not only the patient suffering from it, but also on the healthcare system.[1] Compression therapy is recommended for the management of venous lower leg ulcers, if the ankle-brachial pressure index (ABPI) value is between 0.8 and 1.3. An external pressure of between 30–40 mmHg is required to counteract effects of venous insufficiency.[2] Lower leg ulcers of venous origin tend to present with copious amounts of exudate which is difficult to manage and is a major source of embarrassment, discomfort and pain to the patient.[1,2] Exudate that is not controlled could result in damage to the peri-wound skin and an increase in ulcer size.[2] Dressings used over the last few years included polyurethane foams and alginates. Only recently super-absorbent dressings that are designed to manage high exudate levels were introduced.[2]

The aim of the study was to determine if the interface pressure would increase with the use of a superabsorber (Sorbion®) under a multilayer compression system, in the treatment of venous lower leg ulcers, and if the increase in pressure would affect the wound healing negatively.

The objectives were:

- to measure interface pressure on application and within a given time to determine if the interface pressure increases with the use of a superabsorber under a multilayer compression system;
- to determine if superabsorbers are safe to use under compression in the treatment of venous lower leg ulcers;
- and if the interface pressure increases, would it influence wound healing negatively.

Interface pressure is calculated by using Laplace's Law which states "the pressure produced beneath the bandage is directly proportional to the tension within the fabric, the number of turns applied, but inversely proportional to the circumference of the limb".[2]

Venous ulcers are described as chronic skin and subcutaneous lesions that are commonly found on the lower extremity, especially in the pretibial and medial supra-malleolar areas of the ankle where the perforator veins are located.[3] Venous hypertension is both the aetiology as well as the reason why these ulcers are hard to heal.[4] For operational purposes, lower leg ulcers included in the study would be chronic open wounds around the gaiter area as confirmed by an ABPI of between 0.8 mmHg and 1.2 mmHg.[5]

The superabsorber being tested was the Cutimed Sorbion™ range (dressing size 10x10 cm). Sorbion sachet is a unique composition of cellulose fibres. Superabsorbent polymer-containing wound dressings are best suited to manage highly exudative wounds. These dressings can absorb a large amount of fluid relative to their dry weights. Superabsorbent polymers are the same technology utilised in diapers, feminine hygiene materials, and adult incontinence products. Superabsorbent dressings are typically manufactured from acrylic acid. They undergo polymerisation by suspension or crosslinking, which accounts for their absorptive and protein-binding properties. They have multiple layers, a large absorbent surface, a fluid lock to prevent peri-wound maceration, and a contact layer that protects the wound base from the inner core that can become saturated with wound exudate. The core fluid-locking materials may include powders, crystals, or gelling agents that work through osmosis, with fibres having a capillary-like action.

Multilayer compression systems like Comprifore® are comprised of four layers. Layer one is usually a cotton wool padding, layer two consists of a crepe type bandage and layer three is an elastic bandage. An elastic compression bandage recoils to its original length, creating an inward compression force. The final bandage will become more stiff or inelastic as the number of layers increases. The final and fourth layer is a short stretch cohesive bandage.[1] Elastic bandages usually give 40 mmHg continuous pressure irrespective of calf muscle function.[1]

Method

Twenty volunteers were enrolled using convenient sampling from patients that conformed to the inclusion criteria. Typical characteristics of the participants are determined and described in the inclusion and exclusion criteria. Table I is an outline of the inclusion and exclusion criteria.

An interface pressure device, a superabsorber and a multilayer compression system were applied. (Figure 1 is an illustration of the device being used.) Interface pressure was measured with a Microlab Pico press®. The unit was calibrated before every measurement and has a CE certification (SN PO0420717). The interface device was placed between the dressing and the bandage, the reason being the transducer

Table I. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Active confirmed lower leg ulcer of venous origin ABPI of between 0.9 and 1.3 Wound size of not more than 64 cm^2 (dressing tested was 10x10 cm) thus 64 cm^2 would cover most size possibilities i.e. 4x4, 6x2 etc. Only one wound/leg would be included	Any known allergies to any component of the multilayer system ABPI not within accepted range Wound size bigger than 64 cm^2

Figure 1. Pico-press applied to measure interface pressure

was made of a plastic material and in the first few participants the transducer was placed on the wound bed which resulted in maceration of the wound edges. To prevent maceration, the transducer was placed between the dressing and the bandage. The superabsorber expands both ways thus sub-bandage pressure (interface pressure) was still being measured.

All the patients had a holistic assessment including history and physical examination. Patients with severe cardiac failure or kidney disease that would not have qualified for high compression were not included in the study. CEAP classification of chronic venous insufficiency was used to classify severity of chronic venous disease and no patient with severe lipodermatosclerosis or lymphoedema was included in the study. One patient had a champagne bottle leg but extra wool pad was applied as per guidelines to ensure even distribution of pressure. All patients received standard care as per international guidelines on the treatment of lower leg ulcers. Health dialogue included the fact that the patients could mobilise as needed and needed to elevate their legs when sitting down.

The participants were all followed up within 24 hours after application and interface pressure measurement was repeated, the dressing was left in place, but the leg circumference was measured and a new bandage applied as guidelines state that compression bandaging should be replaced after 24 hours due to reduction in oedema and the resultant slipping of bandages.[6] The participants were then followed up at 72 hours, and at day 7 from implementation. Normal interface pressure range between 40–60 mmHg. Multilayer systems deliver 40 mmHg interface pressure[7]. Interface pressure was measured at: Assessment (Day 0), 24 hours follow-up (Day 1), 72 hours follow-up (Day 3) and Day 7.

The leg circumference was measured in a sitting position with the patient's foot level with the floor (knees in 90 ° flexion). A standardised measuring tape was utilised, and measuring was done over the widest part of the calf, not over the wound as lower leg ulcers of venous origin are characteristically

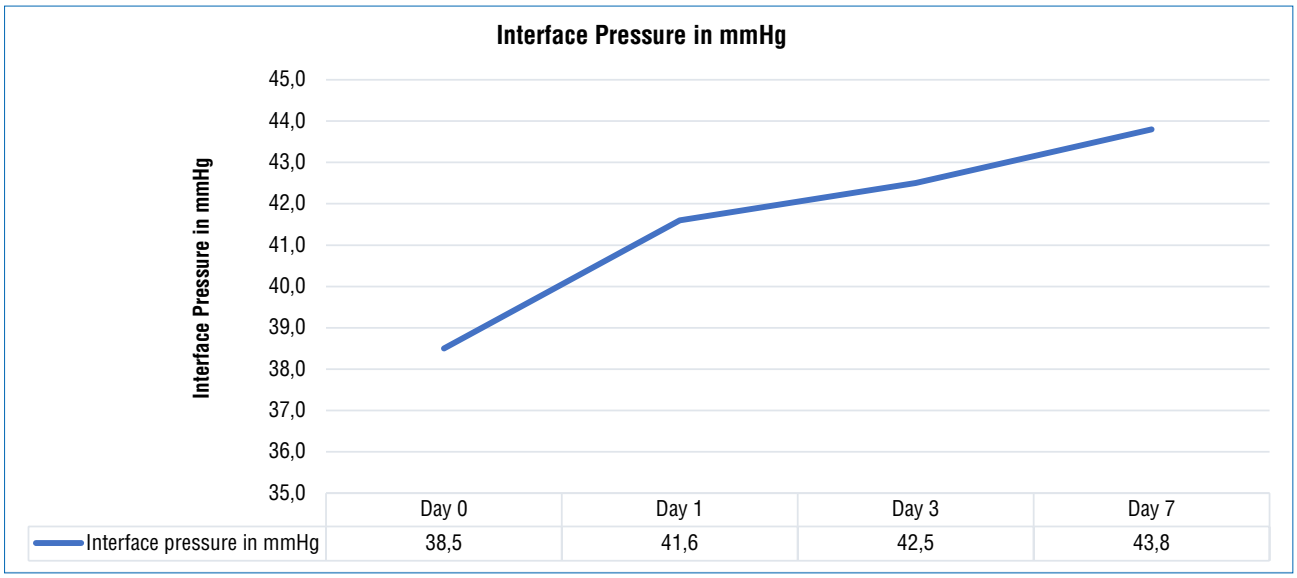

Figure 2. Changes in interface pressure

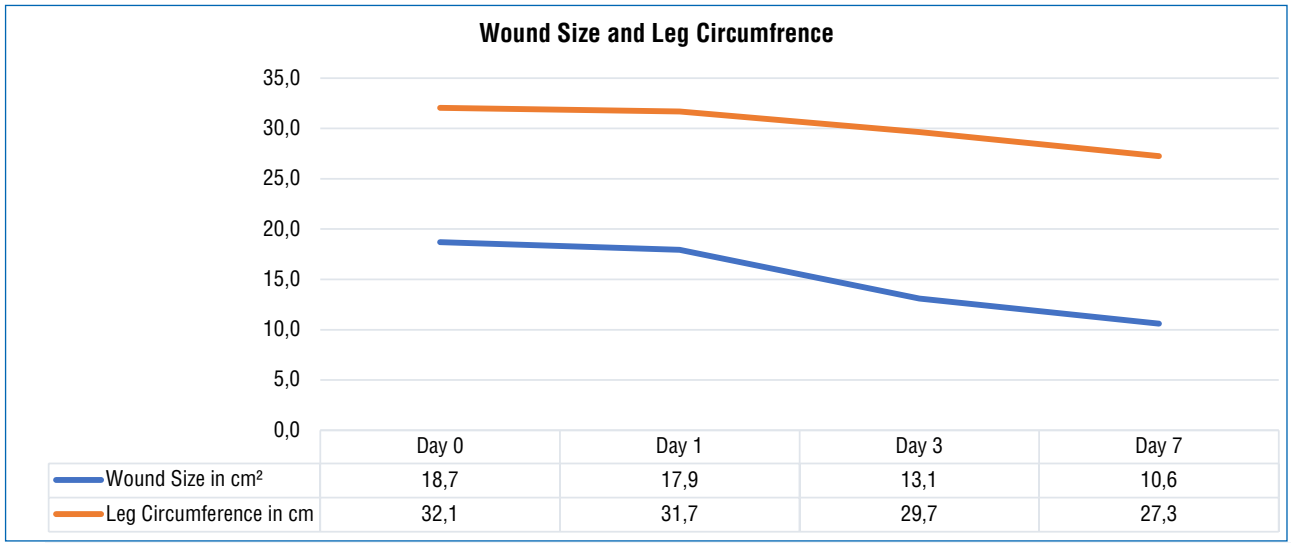

Figure 3. Changes in leg circumference and wound size

located around the gaiter area. The place where the measurement was taken was marked with a permanent marker to ensure that the follow-up measurement was taken on the same place between 10–12 cm below the tibial crest.

Results

Age range was between 30y and 83y with a mean age of 63y.

80% of the participants were female (4 = Male and 16 = Female).

ABPI measured between 0.9 and 1.2 with a mean value of 1.1. Figure 2 is a representation of the mean changes in interface pressure from day 0–7.

Figure 3 illustrates the changes in leg circumference and wound size.

The mean interface pressure measured 38,5 mmHg at day one, 42,5 mmHg at day three and 43,8 mmHg at day seven. Thus, an average increase of 5,3 mmHg in interface pressure from day 0 to day 7 was observed. The interface pressure remained within a range of 40 mmHg to 60 mmHg with all the participants.

It appeared that a decrease in leg circumference was more noticeable at 72 hours follow up with an average reduction of 4,8 cm from day 0 to day 7. The rate of reduction in wound size appeared to be greater at day 3 post assessment with an average reduction of 8 cm^2 form day 0 to day 7.

Limitations of the study

Although the subjects were the typical lower leg ulcer patients, the sample size was relatively small (n = 20). Although the interface pressure monitors were calibrated,

several factors play a role in the accuracy of the measurement such as method of application and limb characteristics (shape of the leg, presence of oedema). These variables were minimised by using the same practitioner and the same measuring device. Unfortunately, interface pressure measurements only supply information on one aspect of the surface.[2]

Conclusion and recommendations

Although there was an increase in interface pressure measured, it appears that the healing was not negatively influenced as there was a reduction in wound size. Therefore, superabsorbers could be utilised to aid exudate management in conjunction with four-layer compression bandaging. Due to the observed increase in pressure, caution should be taken when the wound is larger than 64 cm^2 or circumferential as this might result in a much higher exudate level and more expansion of the superabsorber as larger surface area wounds tend to have a higher exudate level.[8] When using the dressing size 100 cm^2 and the core size a maximum of 64 cm^2. A follow up after 24 hours initial application is advised. Lastly, application of compression therapy should only be done by a skilled practitioner as lack of knowledge and skill could contribute to unfavourable outcomes and increase in cost.

References

1. Woo KY, Cowie BG. 2013. Understanding compression for venous leg ulcers. Nursing, 43(1): 66-68. http://content.wkhealth.com/linkback/openur.
2. Cook L. 2011. Effect of super-absorbent dressings on compression sub-bandage pressure. British Journal of Community Nursing, 16(3 SUPPL.): S38–S43. http://www.scopus.com/inward/record.
3. Franks PJ, Barker J. 2016. Document summary : management of patients with venous leg ulcers : challenges. Journal of Woundcare, 16(1): 81-88.
4. Sieggreen M, Kline RA. 2016. Venous disease and lymphedema management. In S Baranoski & EA Ayello, eds. Wound Care Essentials- Practice Priniciples. Philadelphia: Wolters Kluwer Health: Loc 11997-13342.
5. Flanagan M. 2013. Wound Healing and Skin Intergrity: Principles and Practice.
6. Fletcher J, Moffat C, Partsch H, et al. 2013. Principles of compression in venous disease : Wounds International: 22.
7. Partsch H, Mortimer P. 2015. Compression for leg wounds. British Journal of Dermatology, 173(2):359-369.
8. Tickle J. 2015. Wound exudate assessment and management: a challenge for clinicans.: EBSCOhost. British Journal of Nursing. S38-S43.