

Chronic venous insufficiency and interest of adjustable compression wrap devices

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Abstract

Adjustable compression wrap devices (ACWD) are a heterogenic group which makes it difficult to match them to individual patient in their best way, we tried to characterize these products by their technical features. We bought four different ACWD and compared them regarding construction and handling. ACWD show obvious advantages including self-management, self-application, re-adjustability and standardization of the compression therapy. Basically, all systems are one or more low stretch bandages that encircle the lower leg and adhere to itself with velcro. Some allow for a selective adjustment during the course of the application because in these systems the individual bands mutually intermesh. In others, the bandages must always be opened from proximal to distal in order to retighten individual segments. In addition only one enables the user to control the compression pressure of each segment by a built-in-pressure system. Different technical features of the four ACWDs make it difficult to compare them. For effective compression easy handling, selective adjustments and a reliable pressure control seem to be the most important aspects.

Introduction

Venous leg ulcers (VLU) are one of the most common chronic wounds in industrialized countries.^{1,2} VLU treatment differs fundamentally from that of PU or leg ulcer in case of DFU. Treatment of both, PU and VLU in case of DFU, focuses on relieving the pressure on the wound. In contrast, the effective and successful therapy of VLU requires an increase in pressure that can be achieved by compression therapy.^{3,4} This therapeutic approach is scientifically proven by numerous studies and content of all guidelines on VLU treatment. A Cochrane meta-analysis done by Nelson and Bell-Syer in 2014 also concludes that adequate compression therapy is the basis for successful treatment of VLU.⁵

Although compression therapy has been shown to help heal VLU⁶ and to reduce

recurrence it is not known which interventions help people adhere to compression treatments. Weller *et al.* performed a Cochrane review including randomized controlled trials of interventions that aim to help people with VLU adhere to compression treatments compared to usual care. They reported that it remains unclear whether interventions like Leg Clubs[®] or community-based, nurse-led self-management programs improve venous ulcer healing and reduce recurrence.⁷

Adjustable compression wrap devices (ACWD) using hook and loop fasteners, commonly called velcro brand fasteners, present new opportunities for improving treatment outcomes, supporting patient independence and self-management in the use of compression therapy. In patients with moderate to severe lymphedema of the legs, ACWD achieved a significantly more pronounced reduction in volume after 24 hours than an inelastic multicomponent compression system (MCS). Autonomous handling of ACWD seemed to improve the clinical outcome and is a promising step toward self-management involving effective compression.^{8,9} ACWD is also efficient in reducing stasis edema in the elderly with prolonged immobility in the sitting position.^{10,11} In 40 legs from 36 patients with untreated venous edema re-adjustable ACWDs with a resting pressure of around 40 mmHg are more effective in reducing chronic venous edema than inelastic bandages with a resting pressure of around 60 mmHg. They are also well tolerated, not only during maintenance therapy, but also in the initial decongestive treatment phase.¹² In the two training courses for nurses Partsch showed that in contrast to short stretch bandages (SSB) that are frequently applied by bandagers with too low pressure, the adjustable compression wrap devices handled by the patients themselves produce more appropriate and more consistent pressure.¹³ This result is in line with a study from Protz *et al.* comparing 134 bandages with SSB including padding, 128 bandages with MCSs and 40 bandagings with ACWDs in 137 participants¹⁴ and from Mosti *et al.* who demonstrated in 30 patients without arterial occlusive disease that adequate self-application of ACWD is feasible and that patients can maintain this pressure by re-adjustment.¹⁵ In compliant patients, VLU randomized to nonelastic compression had a significantly faster healing rate per week than ulcers treated by the conventional four-layer compression system.¹⁶ The study analyzed healing rates in 24 extremities of 12 patients with bilateral leg ulcers randomized to have a four-layer elastic bandage in one extremity and a nonelastic compression garment

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circaid[®] in the contralateral limb.

Although they are launched more than 20 years ago in the US and available in several European countries now, the body of evidence to support use of these products is small compared to the frequently used SSB or the MCS. Until today there has not been a critical evaluation of the functionality of the devices to best matching product to patient presentation and ability to use the device effectively. Unlike compression garments, which are classified by compression category (class I/II or flat knit/circular), an algorithm to direct health professionals to best match a specific ACWD to an individual patient presentation is missing.^{17,18} As those ACWD are a heterogenic group, which makes it difficult to match them to individual patient in their best way, we tried to characterize these products by their technical features.

Results

These compression systems are fitted with velcro straps after leg application, allowing quick and easy adjustment irrespective of the therapist's experience in creating short-stretch bandages. The advan-

tages of these systems have led to the fact that the German compression-goods manufacturers now bring these internationally existing systems known as wrap-assemblies under the name of adaptive compression wrap devices to the German market. The different models of adaptive compression wrap devices have a similar structure but nevertheless differ in their handling. Table 1 lists four adaptive compression wrap devices for the lower leg, some of which are already available in Germany or are about to be introduced, and points out the differences in their handling that are important for the patient and the doctor or nurse.

The following points should be emphasized: i) basically, all systems are one or more low stretch bandages that encircle the lower leg and adhere to itself with velcro; ii) these bandages are partly suitable for machine washing and tumble dryer; iii) under the bandage, for hygienic reasons, an underwear stocking supplied by the manufacturers should be worn; iv) an additional foot adaptive compression system is available for all systems; v) only the circaid® juxtacures® from medi and the Compression wrap® from Juzo allow for a selective adjustment of the compression pressure during the course of the application because in these systems the individual bands mutually intermesh. In the other two systems, the bandages must always be opened from proximal to distal in order to retighten individual segments as they overlap each other like a roof tile (Figure 1); vi) medi's circaid® juxtacures® alone enables the user to control the compression pressure of each segment by a built-in-pressure system; vii) all systems are delivered in different lengths; viii) the Ready wrap® from Lohman & Rauscher, the JOBST® FarrowWrap® from BSN medical and the Compression wrap® from Juzo are supplied in 5 different sizes, but the available circumference sizes vary from 3 cm for the Juzo Compression wrap® up to 8 cm for the Ready wrap® from Lohman & Rauscher. Larger reductions in circumferences in the decongestion phase, which do not exactly fit to these dimensions, can therefore not be covered by one system. This is different with medi's circaid® juxtacures®, which can be steplessly reduced from 42 cm to 19 cm in ankle size.

Conclusions

ACWD show obvious advantages for the clinicians

These advantages are self-management, self-application, re-adjustability and standardization of the compression therapy.

ACWD will find their place especially in the VLU therapy in the next few years as an alternative to the widespread compression bandages with SSB. It is even expected that in some areas they will completely replace the compression bandages with SSB, because where possible it will give the person concerned the opportunity to self-manage and where nurses will continue to be responsible for the compression therapy, a standardization of the compression therapy is available. Here, in particular, the systems that allow a control of the applied compression pressure and a simple adjustment of the compression pressure are the most important one.

Pressure control is key in therapy and can only be achieved with some solutions

The arguments for pressure control are most persuading. A recent survey on compression bandages shows that in practice the application of the frequently used SSB is time-consuming, uncomfortable and unsafe in their application, since the applied compression pressure cannot be controlled.¹⁹ MCS were found to have comparable ulcer healing rates to alternative compression systems and be easier to apply. They have similar abilities to maintain pressure as four-layer bandages and better abilities than

SSB; have less slippage than alternative systems; and to be significantly associated with several favourable quality of life outcomes.²⁰ Despite these advantages Sermathanasawadi *et al.* reported that only 27% of the nurses using MCS achieved subbandage pressure within the range they aimed for (30-50 mmHg).²¹ These studies demonstrate the difficulty of achieving the desired subbandage pressure and indicate that a substantial proportion of patients with VLU do not receive adequate compression therapy.^{22,23}

How to avoid complications

In addition evidence-based guidance is needed to inform clinicians on risk factor, adverse effects, complications and contraindications. ABPI values need to be specified and details should be given on the type of compression that is safe to use. Ongoing research challenges the present recommendations, shifting some contraindications into a list of potential indications. Complications of compression can be prevented when adequate assessment is performed and clinicians are skilled in applying compression.²⁴ In elderly patients with mixed leg ulcers and with an absolute >60 mmHg, SSB of up to 40 mmHg does not adversely affect arterial flow and appears clinically well tolerated. Such bandages



Figure 1. In those ACWD in which individual segments overlap each other like a roof tile, for retightening bandages must always be opened from proximal to distal (left). In those ACWD that are made from one piece and the individual bands mutually intermesh retightening is possible for each band without opening the complete ACWD (right).

Table 1. The table attempts to compare the product characteristics, the possibilities of the compression pressure adjustment and the user-friendliness for four adjustable compression wrap devices for the lower leg, some of which are already available in Germany or are about to be introduced. The information is partly taken from the product information and partly from the respective German or English-language homepages of the various manufacturers.

	Ready wrap Lohman & Rauscher	JOBST® FarrowWrap® BSN medical	Circaid® juxtacures® medi Bayreuth	Compression Wrap Juzo
Characteristics of the products				
Construction	6 single sewn together bandages	6 single sewn together bandages	In the whole one part	In the whole one part
Sizes	2 lengths (30, 35 cm) 5 circumferences, each covering 8 cm in the ankle and 10 cm in the circumference of the wall	2 lengths 5 circumferences, each covering 5 cm in the ankle and 8 cm l in the circumference of the wall	3 lengths (28.33, 38 cm) The circumference can be adapted to the ankle from 19 to 42 cm and the calf circumference from 25 to 64 cm	2 lengths (<40, >40 cm) 5 circumferences, each covering 3 cm in the ankle and 6 cm in the circumference
Food compression possible additionally	Yes	Yes	Yes	Yes
Compression				
Dosed	??	??	20-30, 30-40, 40-50 mmHg	30 -60 mmHg
Adjustable	Yes	Yes	Yes	Yes
Controllable	No	No	Yes	No
User-friendliness				
Handling of readjustability	Must be opened from proximal to distal	Must be opened from proximal to distal	Selectively adjustable and controllable	Selectively adjustable

with appropriate levels of compression may aid ulcer healing by treating the venous part of the disease.²⁵ In patients without disturbances of peripheral perfusion higher compression pressure leads to higher proportions of VLU healed, independent of age and could be safely preferred in older patients.²⁶ In conclusion, we need to put more emphasis on the question if the list of contraindications for compression therapy today is still valid or if due to this list many patients remain untreated although they would benefit from compression therapy.

Adherence can be improved and hence save costs

The choice of compression system remains at the discretion of the clinicians based on evidence of effectiveness, patient tolerability, and preference.²⁷ Adherence to compression therapy is reported to be poor, due to a number of factors, including difficulty in applying and removing the compression garments. A literature review was conducted to identify aids, equipment and other approaches to ease the application and removal of compression therapy garments. Some 12 studies were identified. Most studies focused on chronic venous insufficiency and VLU. Four methods of easing compression garment application and removal were identified: i) devices to assist in application and removal; ii) altered compression stocking design; iii) ACWD; and iv) education.²⁸ A small pilot audit recorded the performance of the ACWD and reported in their

early results that this ACWD may provide a simple, clinically effective and patient-acceptable solution for self-care with compression.¹⁷ They concluded that the use ACWD could have the potential to reduce overall health-care burden by reducing necessary skilled treatment visits and/or cost while still achieving good clinical outcomes.¹⁸

Thus the improvement of VLU treatment requires an improvement in the acceptance and implementation of compression therapy and an easy and patient specific pressure control which can be achieved by ACWDs with built-in-pressure systems predominately (Table 1).

Outlook

Successful compression includes more than dosage alone. In addition to dosage, etiology and patient presentation need to be incorporated, including a patient's physical ability to use compression effectively as part of the daily routine, thereby promoting adherence.²⁹ Although ACWDs improve acceptance and implementation of compression therapy there is a need for an individual decision for choosing specific compression devices, which can be adjusted to counteract the individual signs and symptoms in an optimally adopted way in each single patient.^{15,30} Future research has to define the clinical features of the most suitable patients most for different ACWD designs,

the need of additional foot compression and cost effectiveness in different health systems.

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