

# JOBST® LYMPHEDEMA GARMENTS FOR DAYTIME THERAPY

## CUSTOM, MADE-TO-MEASURE COMPRESSION



FLAT KNIT

### JOBST® ELVAREX®

#### OUR GOLD STANDARD FOR FLAT KNIT COMPRESSION

With a natural rubber core, Elvarex® provides unsurpassed structure and control for patients of all shapes and sizes. Offers the very best in comfort and containment for even the most severe cases.



### JOBST® ELVAREX® SOFT

#### COMFORT AND SOFTNESS THAT PATIENTS DESERVE

Elvarex® Soft garments provide a knitting construction and softer yarn for easy donning and they are extremely comfortable to wear. Specifically designed for the management of mild to moderate lymphedema and edema.



### JOBST® CONFIDENCE

#### NEXT GENERATION OF MADE-TO-MEASURE FLAT-KNIT COMPRESSION

JOBST® Confidence, with its innovative 3D knitting method, conforms to individual body shapes and its flexible fabric makes putting on and taking off easier. Specifically designed for the management of mild to moderate lymphedema and edema.



WARP KNIT

### JOBST® CUSTOM SEAMED

#### CUSTOMIZATION AT ITS BEST

JOBST® Custom Seamed garments offer customized designs for every part of the body with countless configurations and options to ensure that patients get the exact garment and fit needed. These custom made, warp knit garments are designed for a wide range of patient indications.



CIRCULAR KNIT

### JOBST® CUSTOM SEAMLESS SOFT CUSTOM MADE COMPRESSION HOSIERY

JOBST® Custom Seamless Soft is a circular knit garment that looks and feels like hosiery. Appropriate for mild to moderate edema and vascular disorders, these garments wick away moisture and help keep skin cool and dry.



### JOBST® BELLAVER®

#### FIRM CIRCULAR KNIT CONTAINMENT

JOBST® Bellavar® is seamless and provides a greater level of containment than JOBST® Custom Seamless Soft. Designed to manage moderate to severe edema in the legs by providing controlled stretch and resistance.



## PDAC Verified HCPCS Codes

	Product	HCPCS CODES Compression Range CCL 1 (18-30mmHg)	HCPCS CODES Compression Range CCL 2 (30-40mmHg)	HCPCS CODES Compression Range CCL 3, CCL 3F, CCL 4, CCL 4S (40+mmHg)
Lower Extremity	FOOT/TOE CAP		A6573	
	KNEE HIGH	A6610	A6553	A6555
	THIGH HIGH	A6656	A6657	A6658
	WAIST HIGH/ 1-1/2 LEG WAIST HIGH	A6562	A6563	A6564
	IF GENITAL SWELLING IS PRESENT, A6571 CAN BE USED INSTEAD.			
	CAPRI/BERMUDA		A6549	
	IF GENITAL SWELLING IS PRESENT, A6571 CAN BE USED INSTEAD.			
Trunk	CHAP	A6559	A6560	A6561
	PANTY GIRDLE (Warped Knit Only)		A6571	
	BODY SUIT (Warped Knit Only)		A6569	
Upper Extremity	VEST (Warped Knit Only)		A6569	
	ARMSLEEVE		Flat Knit A6576 / Warp Knit A6577	
	GLOVE		Flat Knit A6579 / Warp Knit A6580	
Head & Neck	GAUNTLET		Flat Knit A6565 / Warp Knit A6565	
	FACEMASK (Warped Knit Only)		A6567	

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Resource Center:



# JOBST® LYMPHEDEMA GARMENTS FOR DAYTIME THERAPY

## READY-TO-WEAR COMPRESSION



READY-TO-WEAR COMPRESSION

### JOBST® OPAQUE®

SMOOTH AND BREATHABLE FOR INCREASED COMFORT  
 • Knee High, Thigh High, Waist High



### JOBST® MATERNITY OPAQUE

SUPPORTIVE WITH ELASTIC BELLY MATERNITY SOFTFLEX ZONE  
 • Waist High



### JOBST® ACTIVEWEAR

IDEAL COMPRESSION SOCKS FOR AN ACTIVE LIFESTYLE  
 • Knee High



### JOBST® STYLE

COMFORTABLE AND FASHIONABLE IN AN ATTRACTIVE ARGYLE DESIGN  
 • Knee High



### JOBST® FORMEN

THE NEXT STEP IN COMFORT  
 • Knee High, Thigh High



### JOBST® SPORT

ATHLETIC COMPRESSION THAT IS SOFT AND BREATHABLE  
 • Knee High



### JOBST® RELIEF

EFFECTIVE AND AFFORDABLE  
 • Knee High, Thigh High, Waist High, Chap



### JOBST® BELLA™ LITE

THE ENTRY POINT TO JOBST® QUALITY  
 • Armsleeve, Glove, Gauntlet, Armsleeve/Gauntlet Combined



### JOBST® BELLA™ STRONG

COMFORTABLE, COST-EFFECTIVE COMPRESSION  
 • Armsleeve, Glove, Gauntlet



### JOBST® ULCERCARE

EFFECTIVE MANAGEMENT OF A VENOUS LEG ULCER  
 • Knee High



## PDAC Verified HCPCS Codes

	Product	HCPCS CODES Compression Range 18-30mmHg	HCPCS CODES Compression Range 30-40mmHg	HCPCS CODES Compression Range 40+mmHg
Lower Extremity	KNEE HIGH	A6530	A6552	A6554*
	THIGH HIGH	A6533	A6534	
	WAIST HIGH	A6539	A6540	
	CHAP (JOBST® Relief only)	A6536	A6537	
Upper Extremity	ARMSLEEVE	A6578		
	ARMSLEEVE & GAUNTLET COMBO (JOBST® Bella™ Lite only)	A6578, A6582		
	GLOVE	A6581		
	GAUNTLET	A6582		

\* JOBST® UlcerCare only. Kit includes sock and 1 or 2 liners.

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# JOBST® FARROWWRAP® FOR LYMPHEDEMA MANAGEMENT



**HCPCS Codes  
Approved by  
the PDAC**

## JOBST® FARROWWRAP® CLASSIC (30-40 mmHg)

### SHORT-STRETCH COMPRESSION WRAP

JOBST® FarrowWrap® CLASSIC is recommended for patients with moderate to severe edema and is designed to sit flat against skin folds and not dig into the skin. JOBST® FarrowWrap® CLASSIC is suitable for irregular shaped limbs and includes a pair of liners.



#### FOOTPIECE

Approved  
HCPCS Code  
**A6587**



#### LEGPiece

Approved  
HCPCS Code  
**A6583**



#### THIGHPIECE + KNEEPIECE\*

Approved  
HCPCS Code  
**A6585 +  
A6584**

**VARIATIONS:** • Ready-to-Wear (RTW) • Custom-Made (CM) | **COLORS:** TAN

## JOBST® FARROWWRAP® STRONG (30-40 mmHg)

### SHORT-STRETCH COMPRESSION WRAP

JOBST® FarrowWrap® STRONG is made with premium fabric with strong compression and a soft inner layer. It is suitable for patients with a good limb shape and moderate to severe edema - offering a reliable hold for fluctuating edema. JOBST® FarrowWrap® STRONG is suitable for minor skin folds and shape distortion and includes a pair of liners.



#### FOOTPIECE

Approved HCPCS Codes  
**A6587**



#### LEGPiece

Approved HCPCS Codes  
**A6583**



#### KNEEPIECE

Approved HCPCS Code  
**A6584**



#### THIGHPIECE + KNEEPIECE\*

Approved HCPCS Code  
**A6585 + A6584**

**VARIATIONS:** • Ready-to-Wear (RTW) • Trim-To-Fit (TTF) • Custom-Made (CM) | **COLORS:** TAN

## JOBST® FARROWWRAP® BASIC (30-40 mmHg)

### SHORT-STRETCH COMPRESSION WRAP

JOBST® FarrowWrap® BASIC is the economically affordable solution for patients with moderate to severe chronic edema and regular limb shapes. The band length can be changed and trimmed as limb size reduces and it includes removable, double-sided VELCRO® brand tabs. It comes with a JOBST® FarrowHybrid compression sock\*\*.



#### FOOTPIECE

Approved  
HCPCS Code  
**A6587**



#### LEGPiece AND HYBRID LINER

Approved  
HCPCS Codes  
**A6583 + A6594**

**COLORS:** TAN

**HCPSC Codes  
Approved by  
the PDAC**



## **JOBST® FARROWWRAP® 4000 (30-40 mmHg)** **SHORT-STRETCH COMPRESSION WRAP**

JOBST® FarrowWrap® 4000 is ideal for patients with moderate to severe venous and lymphatic conditions with or without a venous leg ulcer present. JOBST® FarrowWrap® 4000 is made with an inner sleeve and includes just four bands for easy application. It comes with a JOBST® FarrowHybrid compression sock\*\*.

**LEGPiece AND  
HYBRID LINER**

Approved HCPSC Codes - **A6583 + A6594**

**COLORS:**

TAN

BLACK

## **JOBST® FARROWWRAP® LITE (20-30 mmHg)** **SHORT-STRETCH COMPRESSION WRAP**

JOBST® FarrowWrap® LITE is made with a double laminated fabric which is durable and soft and offers a lower level of compression than other FarrowWrap® garments. JOBST® FarrowWrap® LITE is ideal for patient with mild to moderate edema and can support patients with sensitive skin and regular limb shapes. Includes a pair of liners.



### **FOOTPIECE**

Approved  
HCPSC Code  
**A6587**



### **LEGPiece**

Approved  
HCPSC Code  
**A6584**



### **THIGHPIECE + KNEEPIECE\***

Approved  
HCPSC Code  
**A6584 + A6585**



### **ARMPiece**

Approved  
HCPSC Code  
**A6588**



### **HAND GAUNTLET**

Approved  
HCPSC Code  
**A6582**

**VARIATIONS:** • Ready-to-Wear (RTW) • Trim-To-Fit (TTF) • Custom-Made (CM) | **COLORS:**

TAN

BLACK

(only available  
for armpiece)



## **JOBST® FARROWWRAP® TOE CAP (15-20 AND 20-30 mmHg)** **READY-TO-WEAR COMPRESSION**

THE JOBST® FarrowWrap® Toe Cap is a trimmable, ready-to-wear garment for managing swelling in the forefoot and toes.

Approved HCPSC Codes - **A6572**

**TOE CAP  
(15-20 MMHG  
OR 20-30 MMHG)**

The following accessories use  
the Verified HCPSC Code **A6593**:  
All FarrowWrap® Accessories,  
FarrowWrap® Liners, VELCRO®, and  
Extra Bands

\* Thighpiece comes with FarrowWrap® kneepiece.

\*\* Note: The sock is a liner and only provides compression at the foot and ankle. Open wounds must be covered with an appropriate dressing before the compression garment is put on.

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# MULTI-LAYER BANDAGES FOR LYMPHEDEMA MANAGEMENT

# JOBST®

**HCPCS Codes  
Approved by  
the PDAC**



## **ARTIFLEX®** **NON-WOVEN PADDING BANDAGE**

Artiflex® is a multipurpose padding bandage that provides cushioning in lymphedema applications. It provides padding around bony or irregular shapes and is also useful as under padding of plaster or synthetic casts. Artiflex® is conformable and air permeable.

Approved HCPCS Code - A6606



## **COMPRIFOAM®** **OPEN-CELL FOAM BANDAGE**

Comprifoam® open cell foam bandage is designed to evenly distribute the pressure from compression bandages over extremities, thus preventing constrictions and supporting an effective compression therapy. Comprifoam® is 100% polyurethane and reusable.

Approved HCPCS Code - A6602



## **COMPRILAN®** **SHORT-STRETCH COMPRESSION BANDAGE**

Unlike long stretch bandages, Comprilan® short stretch provides high working pressure and low resting pressure. It enables for cost-effective treatment, with easy reapplication, when frequent dressing changes are required. Comprilan® is washable and reusable up to 10 times.

Approved HCPCS Code - A6599



## **TRICOFIX®** **LIGHTWEIGHT STOCKINETTE**

Tricofix® protects skin surface under compression, zinc gel or adhesive bandages. Useful as skin protection as a lining for lymphedema wrapping. Tricofix® is 100% cotton for comfort and stretches both lengthwise and crosswise for quick, easy application.

Approved HCPCS Code - A6607



## **ISOBAND®** **ELASTIC MULTIPURPOSE BANDAGE**

Isoband® is an elastic multipurpose bandage, suitable for phlebological indications and compression bandaging for moderate to severe lymphedema. Isoband® is made from 100% cotton for comfort and features short stretch, longitudinally elastic with maximum stretch of 90% for high working pressure.

Approved HCPCS Code - A6599

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# JOBST® LYMPHEDEMA GARMENTS FOR NIGHTTIME THERAPY

HCPCS Codes  
Approved by  
the PDAC

## JOBST® RELAX

SMART DESIGN FOR A BETTER NIGHT'S SLEEP THANKS TO BREATHABLE COMPRESSION TECHNOLOGY<sup>1,2</sup>

JOBST® Relax is designed to counteract fluid accumulation at night. Its special Monofilament Spacer Layer - with moisture managing yarns - delivers the right balance between cushioning and breathability.



**ARMSLEEVE  
WITH ZIPPER**

Approved HCPCS Codes  
**A6523 + A6593\*\***



**ARMSLEEVE  
WITH GAUNTLET**

Approved HCPCS Codes  
**A6523 + A6521\***



**KNEE HIGH**

Approved HCPCS Code  
**A6525**



**KNEE HIGH  
WITH ZIPPER**

Approved HCPCS Codes  
**A6525 + A6593\*\***



**THIGH HIGH  
(15-20 MMHG)**

Approved HCPCS Codes  
**A6527 + A6593\*\***



**THIGH HIGH  
(20-30 MMHG)**

Approved HCPCS Codes  
**A6527 + A6593\*\***

**COLORS:**

Beige

Rosé

## JOBST® BELLISSE®

COMFORT THAT MAKES A DIFFERENCE FOLLOWING BREAST CANCER SURGERY

JOBST® Bellisse® with its special Compressure Comfort®\* inner support system is the innovative solution for the management of breast and chest wall edema. JOBST® Bellisse® is designed to be fully adjustable and provides gentle compression to facilitate lymph drainage from the breast and chest wall.



**BELLISSE**

Approved HCPCS Code  
**A6528**

**COLORS:**

Black

Buff

1. Khalilpour, P. 2018, Evaluation and comparison of JOBST® Relax and Mobiderm® Autofit Armsleeve Fabrics, Vers. 1, P. 1-6.  
2. Bertsch, T. 2018, British Journal of Community Nursing, Vol. 23, No 11, P. 535-541.

# JOBST® JOVIPAK®

## EASY-TO-USE, ALTERNATIVE TO NIGHTTIME COMPRESSION BANDAGING

JOBST® JoViPak is designed to manage edema and lymphedema at night. It's unique, foam filled construction provides pressure into the tissue and, in combination with the JoViJacket, provides additional compression for optimal benefits.



### ARMSLEEVE

Approved HCPCS Codes  
**A6523 + A6521\***



### SHOULDER TORSO ARM SLEEVE

Approved HCPCS Codes  
**A6523 + A6529  
+ A6521\***



### BUSTI

Approved HCPCS Code  
**A6529**



### VEST HALF-PADDING

Approved HCPCS Code  
**A6529**



### KNEE HIGH

Approved HCPCS Code  
**A6525**



### FULL LEG

Approved HCPCS Code  
**A6527**



### BOXER

Approved HCPCS Code  
**A6549**



### BOXER CAPRI

Approved HCPCS Code  
**A6549**



### HIP HUGGER

Approved HCPCS Code  
**A6549**

**JOVIJACKETS ARE  
RECOMMENDED TO USE  
WITH JOVIPAK GARMENTS.  
JOVIJACKETS ARE  
SOLD SEPARATELY**

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\* A6521 Gradient Compression garment, glove, padded, for nighttime use, custom each  
\*\* A6593 Accessory for gradient compression garment or wrap with adjustable straps not otherwise specified

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# NEW RESEARCH CONFIRMS THE COMFORT OF JOBST® CONFIDENCE

Discover the new clinical study on JOBST Confidence, our compression solution crafted for comfort for people living with mild to moderate lymphedema. The research involved 85 lymphedema patients and highlights the unique features of JOBST Confidence.

## PATIENTS PREFER THE COMFORT OF JOBST CONFIDENCE

### RANGE OF MOTION:

**85%** of patients said they can move freely with JOBST Confidence.

### MOISTURE MANAGEMENT:

**92%** of patients agreed JOBST Confidence keeps the skin dry.

### GENERAL WEARING COMFORT:

**84%** of patients evaluated the comfort of JOBST Confidence as good/very good.

### PATIENT SATISFACTION:

**7/10** patients said they would recommend JOBST Confidence.

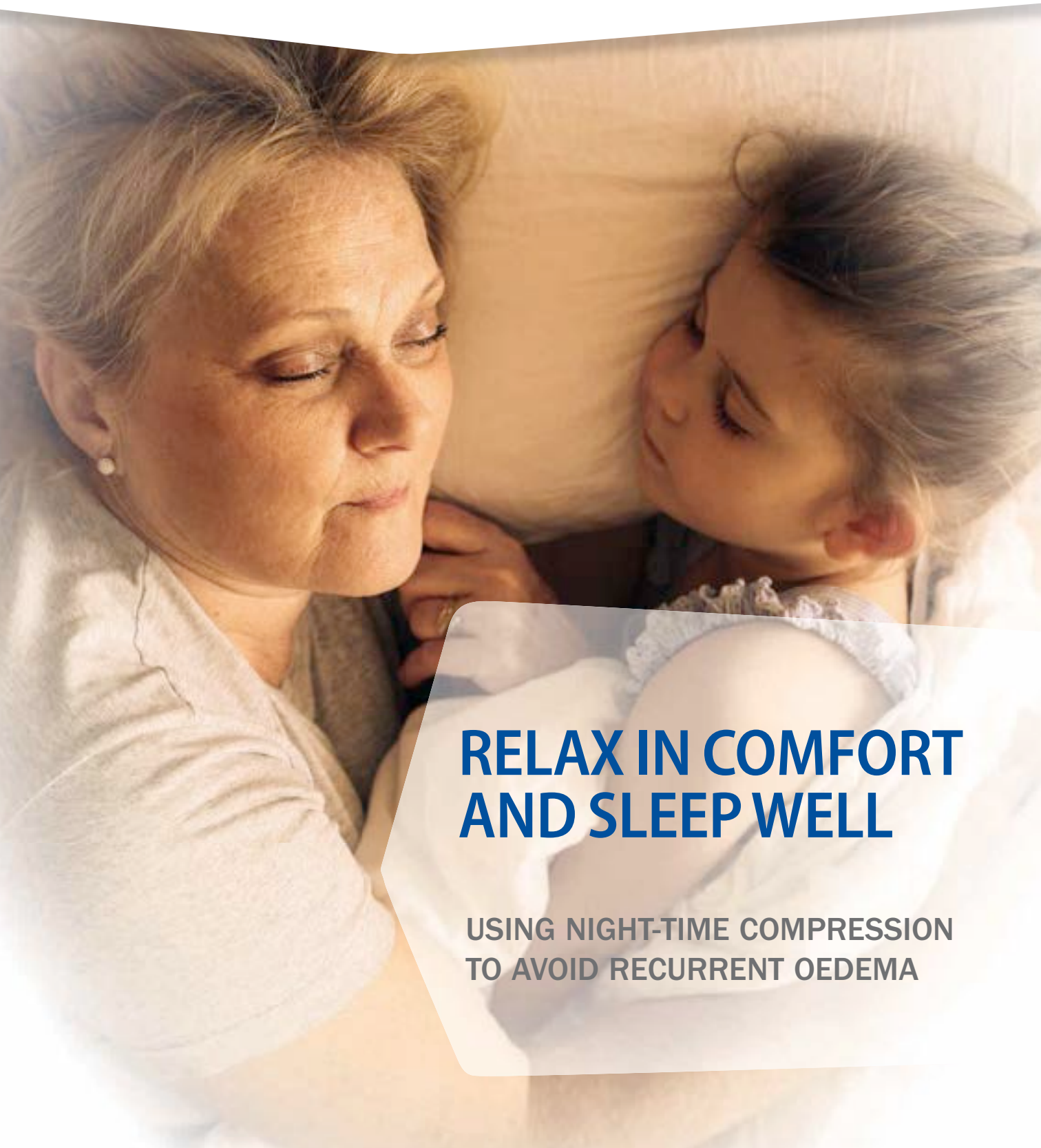
## UNIQUE FEATURES FOR LONG-TERM COMFORT:

**Contour Fit**, innovative knitting technology, allows to adapt the fit of the garment at four positions on the limb (instead of one) to create a garment that truly contours the unique form of your patient's body.

**Advanced moisture management system** with double-layer construction for optimal wearing comfort.

[DISCOVER MORE ABOUT JOBST® CONFIDENCE](#)

AN EDUCATIONAL SUPPLEMENT IN ASSOCIATION WITH:



# RELAX IN COMFORT AND SLEEP WELL

USING NIGHT-TIME COMPRESSION  
TO AVOID RECURRENT OEDEMA

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## Declaration of interest

This supplement was commissioned and supported by BSN medical. Rachel Drago, Rebecca Elwell, Aysha Goodyear, Denise Hardy, Christine Moffatt, Stacy Pugh, Charlotte Stubbs and Justine Whitaker are all independent clinicians who received a fee for their contributions.

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# OBSERVING THE BENEFITS OF NIGHT-TIME COMPRESSION



**CHRISTINE MOFFATT**

PROFESSOR OF CLINICAL NURSING RESEARCH, UNIVERSITY OF NOTTINGHAM AND NURSE CONSULTANT, DERBY LYMPHOEDEMA SERVICE

Over the past few years, it has been increasingly recognised that the current recommendations for compression therapy are not sufficient to ensure long-term maintenance that prevents rebound oedema. Following intensive decongestive lymphatic therapy (DLT), many patients experience a recurrence of their swelling within one year (Quéré et al, 2014). The reasons for this are often extremely complex and difficult to unravel. However, one factor is the typical recommendation that compression therapy should be worn only during the day, rather than for 24 hours (Vignes et al, 2011).

Further research is required to assess the efficacy of products developed to address these issues. This supplement contains cases studies describing patients' and nurses' clinical experience with an advance in compression: JOBST® Relax, a garment that has been specially designed to be worn at night. The outcomes indicate that both health professionals and patients found it beneficial.

Patients with lymphoedema are a highly heterogeneous population, even when the underlying aetiology, such as breast cancer treatment, is considered. As demonstrated in the case studies in this supplement, they can experience many comorbidities which, along with the underlying disease process, will affect their swelling. For example, breast cancer-related lymphoedema is often described as a minor problem that has been largely eradicated due to improvements in surgical technique. Despite this, approximately 25% of patients still develop lymphoedema (Moffatt et al, 2003), although early surveillance might ensure they are identified early and offered treatment to prevent a deterioration. In addition, complex postoperative complications, such as seroma and wound infection, can occur, increasing the risk of swelling, as can wider issues such as obesity and treatments including radiotherapy, chemotherapy, reconstructive surgery and repeated surgery (DiSipio et al, 2013; Paiva et al, 2013; Rebegea et al, 2015).

Lymphoedema in the leg is more complex to manage than arm oedema, and can have a greater impact on quality of life, possibly owing to the effect on mobility, which in turn can cause social isolation (Tiwari et al, 2006).

As the case studies show, the main outcome that facilitates adherence with treatment is patient comfort.

Lymphoedema is a life-long problem and there is a need for garments that can address this issue. In some cases, JOBST Relax was used in patients with brachial plexopathy or who were receiving palliative care, where garments are required that provide comfort as well as compression. The patients' symptoms improved, despite the severity of their condition. In other cases, night-time compression enhanced patients' control of their swelling and provided increased comfort and relief. They also found it aesthetically pleasing.

The case studies also show that patients' preferred outcomes can differ to those of health professionals. Traditionally, the outcome of lymphoedema treatment has been defined as the change in limb volume. While this remains an important factor, given that uncontrolled oedema is associated with pain, numbness, reduced function and cellulitis, factors such as comfort, enhanced wellbeing and improved self-management may be more important to people managing a life-long condition.

The opportunity to use night-time compression to increase the effectiveness of treatment is an important development. Further innovations, like JOBST Relax, are likely in this area for many reasons, including the need for better management and to reduce intensive DLT treatments for recurrent swelling and cellulitis.

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# MAKING NIGHT-TIME COMPRESSION A COMFORTABLE REALITY

**WEARING COMPRESSION 24 HOURS A DAY WILL HELP PREVENT REBOUND OEDEMA. GARMENTS WORN IN BED OVERNIGHT NEED TO BE COMFORTABLE, COOL AND EASY TO DON**

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Compression therapy has been used for centuries to treat disorders of the venous and lymphatic circulatory systems. As long as bandages have been used to manage lower limb problems, compression has been applied at night. Research shows that use of compression at night-time can reduce swelling, but that patients can be deterred from wearing it as they often find it too hot, uncomfortable and difficult to put on (Whitaker, 2016). Until now, no flat-knit compression garment has been designed specifically for use at night. This article explores the benefits of including night-time compression into a self-management regimen, and describes the development of a garment that is compatible with night-time usage.

## Causes and characteristics of lymphoedema

The circulatory system comprises the arterial, venous and lymphatic systems. Arteries deliver oxygen-rich blood from the heart to the tissues, and veins return deoxygenated blood to the heart. The lymphatic system absorbs and filters excess water and waste products, returning this back to the venous system at the subclavian vein (Kesler et al, 2013). It also transports immune cells around the body.

The lymphatic system regulates the amount of fluid in the tissue in a process known as homeostasis. It also absorbs gastrointestinal lipids from the intestine to form chyle (lymph and fat cells), which is taken to the liver for processing. It monitors the movement of antigen-presenting cells and lymphocytes to lymphoid organs, such as the thymus, spleen, tonsils and appendix, and then on to the vascular circulatory system, thereby supporting the immune system (Aspelund et al, 2016).

When this complex physiological system does not function adequately, homeostasis is impaired, resulting in the accumulation of excess fluid in the interstitial spaces. This manifests as swelling in the tissue. If the failure is short term, as in an acute injury, the productivity of the lymphatic system will increase to remove the excess fluid and the swelling will resolve. In more complex situations, where the functioning of the lymphatic system is disrupted on a more permanent basis, the excess fluid is not removed and lymphoedema can develop. Lymphoedema can be either primary or secondary in origin:

- Primary lymphoedema is associated with genetic and congenital disorders of the lymphatic system, such as Milroy's disease and lymphoedema-distichiasis syndrome (Connell et al, 2013)
- Secondary lymphoedema is secondary to another cause, such as cancer and its treatments, venous insufficiency, trauma, infection, immobility and obesity (Browse et al, 2003)

**Table 1. The International Society of Lymphology (ISL) stages of lymphoedema (ISL, 2013)**

Stage	Characteristics
0	Latent or subclinical lymphoedema, which is not evident despite impaired lymph transport, and subtle changes in tissue fluid/composition and subjective symptoms. This stage can last for months or years before the oedema is apparent
I	Early onset of the condition, where there is an accumulation of fluid in the tissue, which subsides with limb elevation. Pitting can occur
II	Limb elevation alone rarely reduces the swelling and pitting is manifest
Late stage II	Excess fat and fibrosis are more evident and pitting may or may not be present
III	This includes lymphostatic elephantiasis, where pitting can be absent, and trophic skin changes, which can result in further fibrosis and fat deposits. There might also be hyperpigmentation, increased skin folds and warty overgrowths

The International Society of Lymphology (ISL, 2013) has published a grading scale for assessing the severity of lymphoedema (Table 1). Stages 0–II are regarded as early/mild, late stage II and III as moderate and stage III can be either severe or severe complex lymphoedema (Figure 1).

The Lymphoedema Framework (ILF) position document, *Best Practice for the Management of Lymphoedema*, promotes a two-phase approach to the treatment and long-term management of the condition (ILF, 2006). As lymphoedema is a chronic condition, self-management is a long-term process requiring commitment and collaborative working from health professionals and the patient.

**DECONGESTIVE LYMPHATIC THERAPY**

Phase 1, which is commonly referred to as decongestive lymphatic therapy (DLT), is initiated when intervention is required to control the swelling, reshape the limb and reduce its volume, soften the tissues, improve limb function and movement, and reverse skin changes. It also involves provision of education on the condition and self-management. In this phase, treatment usually consists of either multilayer lymphoedema bandaging (MLLB) or wrap compression systems, manual lymphatic drainage (MLD), skin management regimens and exercise programmes. In some instances, these are complemented by other techniques tailored to the individual and his or her needs, such as therapeutic movement and exercise using the Lebed method, which is part of Healthy Steps (2017), physical and manual therapy used for the treatment and rehabilitation of soft tissue (myofascial release), and MLD with a hand-held negative pressure wound therapy device. This phase usually lasts for 2–4 weeks, depending on the service delivery plan, the individual’s needs, the severity of the condition and the skill of the lymphoedema clinic staff.

During this phase, treatment lasts 24 hours a day, which means that the individual will sleep in their MLLB or wrap compression system. In general, these are only removed in the clinic, which does not necessarily happen daily. Some bandage systems are only changed twice weekly (Franks et al, 2013).

Once the DLT phase has been completed, phase 2 starts. This is the maintenance phase, where self-management, with or without clinic support, is initiated. Patients are enabled to take ownership—and therefore control—of their lymphoedema through a self-management routine that normalises their life with this condition (Jefferis et al, 2016). This requires an understanding of the condition and how it can be effectively managed in the long term, plus a commitment to adhere with the programme. If this is achieved, it is likely to increase patients’ independence and wellbeing (Jefferis et al, 2016). Components of the maintenance phase include strategies to prevent a rebound of the swelling following DLT, reduce the risk of cellulitis, improve limb function and mobility, and maintain skin integrity. Patients are often recommended a compression garment for the limb or other affected area, such as the breast or genitals.

<b>SEVERE</b>	No pitting, tissue is hard (fibrotic). Distorted shapes of the limb, often with increased skin folds and skin changes
<b>MODERATE</b>	Pitting is manifest. Limbs are misshapen, but not severely distorted
<b>MILD</b>	Slight pitting is possible (when you press your finger on the tissue it leaves a dent that slowly ‘fills’ up again). No or low distortion of limbs

**Figure 1. Categorisation of lymphoedema severity, based on the International Society of Lymphology standards (ISL, 2013)**

**Types of compression garments**

Compression garments used during the maintenance phase are usually either a circular-knit elastic garment or a flat-knit garment. Circular-knit garments are knitted using a cylinder and a fixed number of needles. They are seamless, and the shape is determined by variations in the height of the stitches and tension of the yarn. Flat-knit garments are knitted in one flat piece, which is usually joined to form a seam. The shape of the garment is altered by adding or removing needles. Circular-knit elastic garments are generally produced to a standard size, so are mainly ready to wear, although some can be made to measure (custom-fit). Flat-knit garments are nearly always custom fit and tend to be stiffer due to the knit and their lower elastic properties, although this can differ from manufacturer to manufacturer. As a result, flat-knit garments are often the product of choice after DLT (Todd, 2015). Guidance on when to use flat-knit or circular-knit garments is given in the ILF position document (ILF, 2006).

In the maintenance phase, an increasingly popular alternative to garments is the wrap compression system. This is suitable for some, but not all patients, when self-managing (Whitaker et al, 2015). Most compression garments are indicated only for day use. However, some lymphoedema clinics and professionals will recommend wearing them at night-time, although the rationale for this will vary, depending on the patient and health professional (Whitaker et al, 2015).

**Benefits of night-time compression**

The ILF position document discusses a ‘transition phase’, which occurs when patients move from DLT to self-management (ILF, 2006). During this phase, some individuals will need 24-hour compression to prevent rebound oedema and reverse other symptoms associated with lymphoedema. It is difficult to quantify the number of patients that wear compression at night-time, let alone understand the factors that drive them to wear it overnight, or why they do not do so when recommended. A recent study, undertaken in five western countries (Australia, Germany, Sweden, UK and US), surveyed 94 patients who wore compression overnight during the maintenance phase about their experiences of this. The inclusion criteria were that patients had to have been diagnosed with lymphoedema at least 12 months before entering the study and were wearing night-time compression (in addition to their day garments) at least

once a week as part of self-management. The patients had primary or secondary lymphoedema on different anatomical locations. Data were collected using interview questions during a 45-minute telephone conversation.

Just over one third of participants questioned had initiated night-time compression themselves (Whitaker, 2016), although it should be noted that night-time compression therapy is common practice in three of the five countries (Australia, Sweden and USA) from which patients were recruited. According to the results, reasons for not wearing compression at night-time included:

- › Being too exhausted and tired to put on compression at night (27% of patients)
- › Heat or temperature (20%)
- › The oedema was already stable (18%)
- › ‘Wanted to give myself a break’ (14%)
- › Skin problems (5%).

Many participants wore products that are generally used in both DLT and for self-management, such as MLLBs, wrap compression systems and daytime compression garments. They stated that the products available to them at that time for night-time use had the following drawbacks:

- › They were uncomfortable to wear
- › They were too hot and caused sweating
- › They made the skin itchy
- › They slipped down the limb during the night
- › They were time consuming to don at the end of the day
- › They disturbed their sleep.

The Whitaker (2016) study also demonstrated benefits of night-time compression. In total, 89% of patients reported that their swelling increased when night-time compression was not used. Circumferential measurements of the ankle, calf and thigh in the lower limb were monitored at bedtime and in the morning. The swelling was reduced or maintained at the same level in 86% of the thigh, 87% of the ankle, 83% of the arm and 86% of the wrist measurements (Table 2). Subjective findings included that night-time compression reduced swelling and was associated with less pain and better sleep (Whitaker, 2016). Using compression did not deter the patients from undertaking skin care and other methods to soften the limb, with almost all (97%) stating that they used two or more other products, such as moisturiser, padding and intermittent pumps.

Other evidence on the benefits of night-time compression include a Japanese evaluation involving

patients with breast cancer-related lymphoedema treated with MLLB. After undergoing a 2-week training course on self-bandaging, the patients independently applied MLLB at night-time for 7 days. Both objective measure of segmental total body water (STBW) in the upper limb, measured with bioimpedance spectroscopy, and subjective measures of tightness, heaviness and fullness decreased, suggesting that the swelling and swelling-related symptoms improved when night-time MLLB was included in self-management (Keisuke et al, 2017). However, it should be noted that this evaluation had a sample of only eight patients and the inclusion criteria were not clearly stated. Due to the lengthy time commitment involved, a 2-week course on applying MLLB at night not be a feasible management strategy for most patients.

### Developing a night-time compression garment

When developing night-time compression products, manufacturers need to take patients’ needs into account and understand what deters them from wearing them. When managing a long-term chronic condition, the use of tailored products designed for a specific purpose, such as to provide comfortable compression at night, will help improve clinical outcomes. According to the ILF, this could reduce the incidence of cellulitis and, in turn, hospital admissions and decrease the number of episodes of DLT, thereby achieving considerable cost savings (ILF, 2006).

In 2016, an Australian study investigated the economic impact of breast cancer-related lymphoedema in a national sample of 361 women (Boyages et al, 2017). The authors cited National Hospital Cost Data Collection cost data, published in 2014, stating that the average cost per admission for cellulitis was AUS \$4102 (£2418) for less severe and AUS \$9605 (£5342) for more severe cases (currency conversion to UK sterling based on September 2017 exchange rates). Obviously, this will also have economic implications for patients, with 56% of Boyages’ entire sample reporting that their condition affected them financially. This rose to 83% when just those with severe lymphoedema were asked about this. Boyages study is one of the few studies to consider the financial burden of lymphoedema for patients. This should be considered when calculating the full economic burden of lymphoedema.

**Table 1. Circumferential measurements of the upper and lower limb: night vs morning**

	Upper limb*			Lower limb**		
	Beneath armpit	Elbow crease	Narrowest part of wrist	Ankle	Calf	Thigh
Lymphoedema increased	13%	14%	9%	7%	10%	6%
Lymphoedema stayed the same	38%	46%	63%	27%	29%	37%
Lymphoedema decreased	45%	36%	23%	60%	54%	49%

\*Measurements recorded on 21 respondents over 101 nights \*\*Measurements recorded on 45 respondents over 415 nights

Patient self-management will benefit from the development of products that deliver tailored care. However, it is important that such products are developed in consultation with patients as this will ensure they meet their needs and preferences. The participants in Whitaker's study were asked how the night-time product that they were using during the study could be improved. The main feedback related to the need for a more comfortable product, with 28% suggesting that it should be made from a different material and 18% identifying 'required improvements': the product needed to be less tight, to not cut into the skin and be free of slippage. Fourteen percent said it would be helpful if the product were easier to don and doff, which supports another finding in the study that 15% needed help to don their garments. Finally, 13% stated that it would be beneficial if the garment were made from a breathable material, to help prevent the patient feeling too hot at night-time when wearing it (Whitaker, 2016).

### JOBST RELAX

A night-time compression solution has been developed that gives patients an alternative to using MLLB, daytime compression garments and wrap compression systems at night-time. JOBST Relax (BSN medical) provides the oedema control that patients need at night-time and when relaxing, as well as the look and comfort that they want. It is indicated for use in the maintenance phase and is designed for individuals who are looking for a garment that will better suit their lifestyle.

JOBST Relax is custom-fit, flat-knit garment, and so is shaped to stay in place. This also ensures its pressure gradient remains consistent. Its textured surface has a micro-massage effect that is designed to stimulate lymph flow. To aid comfort, the garment has a monofilament spacer layer that provides cushioning and can adapt to different sleeping positions.

One of the main issues identified in Whitaker's study was that patients become too warm in bed when wearing a night-time compression product. JOBST Relax is designed to address these issues: it contains breathable Coolmax® yarns, which are knitted into the garment using advanced knitting techniques.

The garment is produced in styles for the upper and lower limb. Available in a range of colours, it is machine washable and can be tumble dried at a low temperature.

JOBST Relax is available in US compression class 1 (15–20 mmHg) for the upper limb and US compression class 1 (15–20 mmHg) and class 2 (20–30 mmHg) for the lower limb, for which there are below-knee and above-knee options. As with all compression garments, it is important to be aware that the compression applied is influenced by many factors, such as the material (both compression class and elasticity) from which the garment is made, the size and shape of the leg, and the activity of the wearer (Rabe et al, 2008). Like all flat-knit, custom-fit garments, the swelling must be reduced as

much as possible before JOBST Relax is applied, as the aim is to maintain the reduction and prevent rebound swelling when combined with daytime compression. Failure to do this will result in the garment becoming loose within a short space of time.

To achieve a good clinical outcome, it is essential that it is used on suitable patients, such as those who are prone to rebound swelling and who are willing to wear compression at night-time.

## Conclusion

This article has described the evidence on the clinical benefits of night-time compression and the development of a garment specifically designed to facilitate this. The rest of this supplement comprises case studies describing nurses' and patients' clinical experiences of JOBST Relax.

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# PATIENT WITH LYMPHOEDEMA EXACERBATED BY A FALL

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A 73-year-old woman developed mild breast cancer-related lymphoedema in her right arm immediately after a mastectomy and axillary node clearance with chemoradiotherapy. The lymphoedema was graded as stage I, according to the International Society of Lymphology (ISL) standards (ISL, 2013). Her comorbidities included arthritis, obesity and hypertension.

The patient was promptly referred to the lymphoedema clinic, where she was instructed how to self-manage her lymphoedema with exercise, skin care and by wearing a circular-knit, graduated compression class 2 (20–30 mmHg) combined armsleeve. After attending a patient education pathway programme at Kendal Lymphology Centre, where she received theoretical and practical advice as well as peer support, she became extremely proactive in her own care and within one year was discharged from the clinic as an 'expert patient'. Following her discharge, she continued to adhere to her lymphoedema management programme in the knowledge that she could access the clinic at any time should problems arise.

In the autumn of 2016, 4 years after her discharge, the patient fell and severely injured the shoulder of her lymphoedematous right arm. The ensuing reduction in arm/shoulder movement impaired her lymph drainage and her lymphoedema deteriorated to become moderate. She was therefore referred back to the clinic.

Due to the increased size (by up to 4 cm in places) and distorted shape of the limb, a 3-week course of decongestive lymphatic therapy incorporating multilayer lymphoedema bandaging, manual lymphatic drainage, skin care and exercise ensued. The limb responded well and a custom-fit, flat-knit, graduated compression

class 2 (23–32 mmHg) combined armsleeve with gauntlet was prescribed. In line with current guidance (Template for Practice, 2009), the patient was advised to apply the armsleeve first thing in the morning, when swelling is at a minimum, remove it at bedtime and then use a moisturiser to keep the skin in good condition.

At the one-month follow-up, the arm measurements had increased (*Table 1*) and the tissues were becoming firm and fibrotic, especially on the forearm and dorsum of the hand (*Figure 1*). Despite physiotherapy, she still had difficulty exercising the limb, and the pain and discomfort were exacerbated by having to tug on a compression garment. In addition, the pins and needles in her fingers, which were related to the fall, were becoming troublesome, especially at night. She now required an applicator to don her garment.

To overcome these issues, a ready-to-wear, short-stretch wrap compression system (20–30 mmHg), which is useful for patients with fluctuating/rebound oedema



Fig 1. The limb before JOBST Relax was first used

**Table 1. Comparative measurements: before and during therapy with JOBST Relax**

	One month after DLT (creeping rebound) (cm)		Before fitting JOBST Relax (cm)		After 10 days of therapy with JOBST Relax (cm)		After 1 month's therapy with JOBST Relax (cm)		After 3 months' therapy with JOBST Relax (cm)	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Hand	21.5	20.5	22.0	20.6	21.7	20.6	21.0	20.6	20.1	20.6
Wrist	24.0	20.0	24.4	20.1	24.0	20.1	23.5	20.0	23.1	20.1
Forearm	35.2	29.0	36.1	28.8	35.8	28.9	34.9	28.9	34.1	28.8
Elbow	41.0	38.0	41.8	37.9	41.4	38.0	40.6	38.0	40.0	37.8
Upper arm	45.8	41.2	46.5	41.1	46.0	41.1	45.5	41.0	44.6	41.0
Axilla	45.0	42.0	45.9	42.0	45.5	41.9	45.0	42.0	44.1	42.1

and/or donning and doffing problems, was prescribed. The patient found this easier to apply and was able to adjust the pressure as required. Keen to self-manage her condition, she even wore the wrap compression system at night-time. Unfortunately, she felt it was too bulky and inflexible to wear in bed and, despite feeling that it was helpful, eventually gave up.

Nevertheless, inspired by this and the increasing clinical discussion about the benefits of night-time compression therapy, the patient was urged to try an old ready-to-wear, circular-knit armsleeve overnight. The patient was aware that there was no research or evidence, at that point, to support the use of a night-time compression, and that, as it was an 'old' garment, the compression levels could no longer be guaranteed. She initially found the armsleeve helpful, but was unable to tolerate it for the entire night due to a feeling of excessive tightness, which had not been apparent during the day, and slippage/bunching, which caused constriction. The arm was showing a creeping refill, with a 1 cm increase in all areas.

The patient therefore eagerly accepted an offer to evaluate JOBST Relax. She was prescribed a JOBST Relax custom-fit, compression class 1 (15–20 mmHg) combined armsleeve with gauntlet. The patient immediately enthused about the product: she loved its pink colour, which she considered more attractive and feminine than the usual beige or black, and was delighted by its ease of application. *Figure 2* shows the JOBST Relax in place. Even though the JOBST Relax and her usual day garments (custom-fit, flat-knit, combined armsleeve) had the same measurements, the patient found JOBST Relax easier to don and the applicator was no longer required.

At a follow-up assessment 10 days later, measurements at fixed points on the arm demonstrated a 0.3–0.5 cm reduction in limb size (*Table 1*), and the subcutaneous tissues were more soft and supple, particularly on the forearm. The patient was delighted with these results and keen to continue using the garment, especially when she realised that she could wear it in the evenings when relaxing, as well as overnight.

*'At the end of the day, I can't wait to get into my PJs and put my feet up to watch the telly. Now, I can take off my normal compression garment and put on my comfort sleeve [JOBST Relax garment]. I can really snuggle down and feel as though I'm still doing what I can to help my arm.'*

After one month, the circumferential measurements of the arm continued to show a slight further reduction (*Table 1*). Although these were small differences, there was a notable improvement in the shape and size of the limb. The appearance of the tissues was much improved, especially over the hand and forearm (*Figure 3*). The creeping refill that had been so problematic following her intensive treatment appeared to have been controlled. Her limb function and movement had improved markedly, aided in part by physiotherapy, and the pins and needles had gone.

*'I now feel back in control of my lymphoedema, rather than the other way round!'*



Fig 2. JOBST Relax fitted and in place

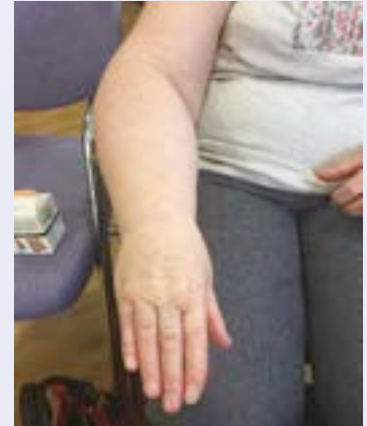


Fig 3. The limb after one month's therapy with JOBST Relax



Fig 4. The limb after 3 months' therapy: the size and shape of the limb had improved, as had the appearance of the fibrotic tissues, especially on the hand and forearm

At the 3-month follow-up, the circumferential measurements had reduced by 1.5–2 cm at various points along the limb. The tissues were softer and the limb function and movement were much improved (*Figure 4*).

While the use of night-time compression for patients with lymphoedema needs further research, this case study demonstrates how beneficial, comfortable and patient-friendly it can be as part of an expert, self-management programme.

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# PATIENT UNABLE TO WEAR A DAY ARMSLEEVE FOR WORK-RELATED REASONS

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**T**his case study describes a 56-year-old man with a history of malignant melanoma, for which he underwent node dissection in the left axilla. He had no other relevant past medical history. Before surgery, in accordance with the treatment pathway for patients with this condition, moisture meter readings were undertaken and his limbs and trunk volumes were measured using perometry. The results were within the normal range (*Table 1*). The patient was given verbal and written information about the risk of lymphoedema and advice on skin care and exercise. He was also provided with the contact details of the lymphoedema clinic for self-referral, if necessary.

Within 6 weeks of the operation, the patient developed lymphoedema in his entire left upper limb from the wrist upwards. He contacted the lymphoedema service and subsequent perometry measurements showed that the volume of his left arm had increased by 13% (*Table 1*).

The patient had stage I/II lymphoedema, according to the International Society of Lymphology (ISL) standards (ISL, 2013), which is considered to be mild lymphoedema.

The patient did not complain of any pain, although it was noted that his axilla and post-axillary pouch were numb. The subcutaneous tissues were soft and non-pitting, and the skin was intact and in good condition.

A treatment plan comprising skin care, exercise and compression garment in the form of a ready-to-wear, circular-knit armsleeve was discussed with the patient. However, his job as a hospital healthcare assistant required him to be 'bare below the elbows,' and thus a compression armsleeve that had to be worn during the day was not deemed suitable. It was suggested that he

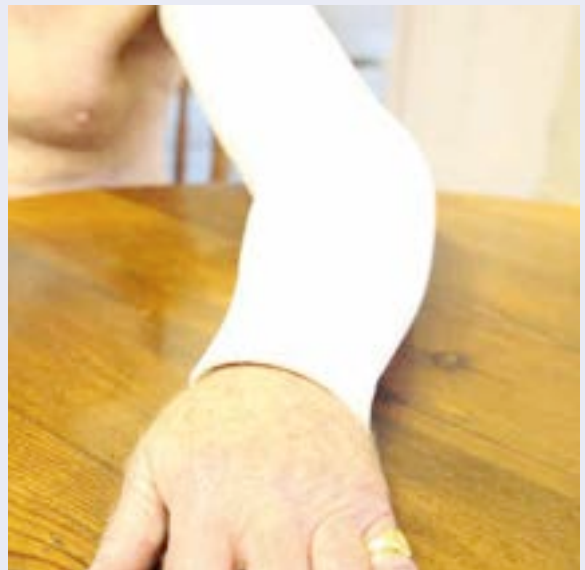


Fig 1. JOBST Relax in place at 3-month follow-up

try a night-time garment (JOBST Relax) instead. It was explained that there was not yet any evidence on its use without daytime compression, so the outcome could not be predicted. Nevertheless, he was keen to try it.

The patient was measured for a JOBST Relax custom-fit armsleeve, without gauntlet, in compression class 1 (15–20 mmHg). He was instructed on how to apply and remove it, and how to look after it. He agreed to wear it nightly, and to adhere to the recommended skin care and upper limb exercises. A follow-up appointment was arranged for 3 months' time.

**Table 1. Comparison of limb sizes**

Before surgery	Postoperatively (week 6)	3-month follow-up	Reduction in excess limb volume (postoperative week 6 vs 3-month follow up)
Left arm: 2577 mm Right arm: 2559 mm Excess limb volume: 18 ml (0.7%)	Left arm: 3388 mm Right arm: 2973 mm Excess limb volume: 415 ml (13.9%)	Left arm: 2995 mm Right arm: 2897 mm Excess limb volume: 98 ml (3.4%)	-10.5%

Table 1 shows the limb volume measurements recorded before surgery, postoperatively and after 3 months of therapy with JOBST Relax. Not only had the oedema reduced, but also the patient subjectively reported that his arm felt 'more normal'. He found the garment easy to apply and remove, comfortable to sleep in and a good fit. He would often wear it in the evenings while relaxing and watching television. Prescribing

JOBST Relax proved to be a creative and effective way of enabling this patient to self-manage his lymphoedema without impairing his employment prospects.

International Society of Lymphology (2013) The diagnosis and treatment of peripheral lymphedema: 2013 Consensus Document of the International Society of Lymphology. *Lymphology* 46(1): 1–11

# PATIENT WITH EXTREMELY SWOLLEN LEGS CAUSED BY LIPO-LYMPHOEDEMA

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This case study describes a 58-year-old woman with lipo-lymphoedema in both legs (lipo-lymphoedema is lipoedema that has resulted in failure of the lymphatic system). Both her mother and daughter also have lipo-lymphoedema, with the severity relating to age. The patient was a full-time primary school teacher. As she lived on a farm, she also helped with the farm work when at home. She was morbidly obese with a body mass index (BMI) of 57.

In 2014, both of the patient’s legs were extremely swollen, with her right leg being the most affected with a limb volume of more than 10 litres (Table 1 and Figure 1). Not only were her legs extremely painful, but she also had arthritic pain in her knees. She subsequently developed a superficial venous leg ulcer and cellulitis in her right leg.

In September 2014, the patient underwent a 19-day course (10 sessions) of decongestive lymphatic therapy (DLT) consisting of intermittent pneumatic compression

**Table 1. Comparative reduction in the volume of the right leg reported after the initial course of decongestive lymphatic therapy (2014), at subsequent follow-ups with manual lymphatic drainage and self-management (2015), and during therapy with JOBST Relax (2017)**

	Decongestive lymphatic therapy (DLT) (2014)		Self-management without JOBST Relax (2015)	Self-management with JOBST Relax (2017)	
	Initial assessment pre-DLT	Post-DLT		Pre-fitting for JOBST Relax	Week 4 of therapy with JOBST Relax
Limb volume (ml)	10244	6347	6697	6660	5747
Change in volume (ml) vs. the initial assessment (2014)		-3897	-3547	-3584	-4497
Change in volume (ml) since the previous reported measurement			350	37	-913



Fig 1. The patient's legs before decongestive lymphatic therapy was undertaken in 2014



Fig 2. The patient's legs after 10 sessions of decongestive lymphatic therapy

therapy, manual lymphatic drainage (MLD) with a hand-held negative pressure wound therapy device and multilayer lymphoedema bandaging (Whitaker et al, 2015). Over the course of DLT, the limb volume in her right leg reduced from 10244 ml to 6347 ml and she lost 21 kg in weight, with her BMI reducing to 48 (Figure 2). After this, she received monthly treatments of MLD and self-managed with custom-fit, flat-knit, RAL compression class 3 (34–46 mmHg) graduated compression tights and a below-knee wrap compression system, which she wore all day until bedtime.

The patient had felt comfortable wearing her multilayer bandages at night while receiving DLT; therefore, at various intervals during the following year, she wore a RAL compression class 2 (23–32 mmHg) below-knee garment at night. Unfortunately, she had to stop wearing this due to funding issues. Despite adhering to her self-management regimen, she was concerned that not wearing compression at night would place her at risk of rebound oedema.

In 2017, after seeing a brochure about JOBST Relax in the lymphoedema clinic waiting room, the patient asked if she could purchase it privately, as it was not on prescription. The patient suggesting evaluating it on just her right leg in the first instance, which was still slightly more swollen, to see if it would be effective.

A JOBST Relax custom-fit, knee-high garment in

compression class 2 (20–30 mmHg) was ordered for the patient. The patient agreed to wear this garment at night, but otherwise continue with the same self-management regimen that she had followed in the previous 3 years.

In order to conduct the evaluation, the patient discussed with the lymphoedema nurse consultant how she could measure her legs herself at home. The patient suggested using a permanent marker to place dots at specific locations on her foot, ankle and calf, where the measurements would be taken. With support and advice from the consultant nurse, the patient drew the dots herself at approximately the same locations as would be used to measure for a ready-to-wear garment, as it was thought this would be more likely to result in consistent measurements. The consultant nurse taught her how to do the measurements: stating that she should first measure the middle of the sole of the foot and then the ankle, record the measurements, and then continue up the calf. During the first 4 days of therapy with JOBST Relax, the patient measured both legs in this way each morning and last thing at night.

The results showed that, on day 4, there was a greater reduction in the circumferential measurement of the right leg (Table 2). This compared well with the reduction achieved in 2015 with self-management without JOBST Relax.

**Table 2. Reduction in size reported by the patient in her left and right legs during the first 4 days of therapy with JOBST Relax**

Date and time		Ankle (cm)		Calf (cm)		Below knee (cm)	
		Left leg	Right leg	Left leg	Right leg	Left leg	Right leg
Day 1	Night	43.0	47.0	57.0	63.0	63.0	67.0
Day 2	Morning	42.0	41.0	54.0	55.5	60.0	61.0
	Night	42.0	44.0	55.0	58.0	62.0	65.0
Day 3	Morning	43.0	42.0	53.0	56.0	60.0	62.0
	Night	41.0	42.0	54.0	59.0	61.0	64.0
Day 4	Morning	44.0	42.0	54.0	55.0	60.0	61.0
	Night	41.0	42.0	54.0	54.0	61.0	62.0
<b>Maximum reduction in size (day 4 vs day 1)</b>		<b>2 cm</b>	<b>5 cm</b>	<b>3 cm</b>	<b>9 cm</b>	<b>3 cm</b>	<b>6 cm</b>

Motivated by these results, the patient decided to keep wearing JOBST Relax on her right leg at night-time. After 4 weeks, she lost nearly one litre of fluid (913 ml) below the knee of her right limb, and the garment started to feel loose.

*'It now feels like it fits loose and drops down 4 cm when I walk around.'*

Full details on the reduction in limb volume achieved with DLT and self-management with and without JOBST Relax are given in *Table 1*. Measurements were captured using the 4 cm limb volume calculation measurement system (Williams and Whitaker, 2015). As the patient's lymphoedema was bilateral, the effectiveness of treatment could only be determined by measuring the limb volume (ml) and comparing with previous measurements (Williams and Whitaker, 2015).

Previously, the patient had experienced aching and discomfort in both legs at night-time. This disappeared in her right leg while she was wearing JOBST Relax as part of her self-management routine. The left leg continued to be affected.

*Figure 3* shows the night-time garment in place. The patient stated that she found JOBST Relax soft and comfortable to wear.

*'Most nights I'm aware of my legs aching during the night, but didn't on the right when I wore [JOBST] Relax.'*

Based on this case, the lymphoedema service will consider using JOBST Relax to increase the reduction in limb size immediately after DLT.



**Fig 3. The limb with the JOBST Relax garment in place**

*'Very soft, comfortable to wear.'*  
*'Felt heavy at first but getting used to it.'*  
*'Didn't stop me getting to sleep.'*  
*'Label does not itch on the seam.'*  
*'Didn't glide through bed sheets – husband complained that they came with me, leaving him without [the sheets]... ha,ha,ha...'*

Whitaker J, Williams A, Pope D et al (2015) Clinical audit of a lymphoedema bandaging system: a foam roll and cohesive short stretch bandages. *J Wound Care* **24**(3): 83–94

Williams A, Whitaker J (2015) Measuring change in limb volume to evaluate lymphoedema treatment outcome. *EWMA J* **15**(1): 27–32

# BREAST CANCER-RELATED LYMPHOEDEMA AFFECTED BY RECURRENT INFECTIONS

**RACHEL DRAGO** ADVANCED NURSE PRACTITIONER AND TEAM LEADER LYMPHOEDEMA, ST WOOLOS HOSPITAL, NEWPORT

**T**his case study concerns a 48-year-old woman who had a modified radical mastectomy and axillary node clearance in 2009 for stage 3 locally invasive ductal breast cancer. Following this, she underwent chemotherapy and radiotherapy, but developed lymphoedema in her left arm during radiotherapy. In 2011, she underwent deep inferior epigastric perforator breast reconstruction.

Since February 2010, she has experienced relapsing and remitting cellulitis in her left arm. On three separate occasions, she was admitted to intensive care with cellulitis in her arm and sepsis, for which she was treated with intravenous antibiotics. In 2016, she was prescribed long-term prophylactic antibiotics (phenoxymethylpenicillin 250 mg), to be taken twice daily, with the aim of preventing further incidents of cellulitis. She also had radiotherapy-induced lung fibrosis, for which she took regular oral antibiotics and occasional short courses of corticosteroid therapy (30mg prednisolone).

The patient had stage II lymphoedema according to the International Society of Lymphology (ISL) standards (ISL, 2013), indicating that she had stable moderate arm and hand lymphoedema. She had slight fibrosis of the proximal tissues and fluctuating pitting oedema in the distal arm and hand. For the past 8 years, the patient had self-managed her lymphoedema, wearing a custom-fit, flat-knit RAL compression class 2 (23–32 mmHg) armsleeve for at least 14 hours a day and, occasionally, a glove, undertaking simple lymphatic drainage and skin care, and keeping her body mass index <30 through diet and exercise.

When she was in her best state of health, with no active infections (skin or lung), the total excess limb volume of her left arm was 18%, but this would increase to 30–35% during episodes of chest infection and/or cellulitis. This increase was mostly caused by her inability to wear a compression armsleeve due to severe pain and because of the tissue swelling resulting from steroid therapy. The patient stated that she usually recovered slowly from episodes of cellulitis, with the increased pain and a feeling of heaviness in her arm lasting for up to 3 weeks after the infection had resolved. During these periods of infection, she would try to wear a custom-fit, flat-knit RAL compression class 1 (15–21 mmHg)

armsleeve day and night until she could tolerate a compression class 2 garment during the day.

In April 2017, after JOBST Relax had been made available, the patient evaluated it in the hope that it would help to control her limb volume during these recurrent episodes of chest infection and cellulitis. She would wear her JOBST Relax armsleeve in compression class 1 (15–20 mmHg) overnight.

While objective circumferential limb volume measurements did not show any change in limb volume or tissue pliability following therapy with JOBST Relax, the patient subjectively reported that the distal part of the limb appeared to have decreased in size, there was less pitting in her forearm and the sensation of heaviness had reduced. Most importantly, she felt that her recovery from cellulitis was more rapid and she was able to wear her day garment just a few days after her infection had been brought under control, compared with at least 3 weeks previously. She also found the JOBST Relax compression garment more comfortable and cooler than her usual custom-fit, flat-knit RAL compression class 1 armsleeve in the evenings and at night.

The JOBST Relax garment has enabled this patient to better self-manage her lymphoedema during episodes of infection. This has had an ultimate effect of reducing both the perceived heaviness of her limb and the limb volume. It also enabled her to resume her normal activities of living more quickly than had been possible previously and to return to work, reducing her loss of earnings and costs to her employer.



# LOWER LIMB LYMPHOEDEMA THAT RECURRED AFTER DECONGESTIVE LYMPHATIC THERAPY

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This case study describes a 53-year-old man with a history of Graves' disease (overactive thyroid gland) and primary lymphoedema in his left lower leg. The patient had stage III lymphoedema according to the International Society of Lymphology (ISL) standards (ISL, 2013). There was a large amount of fluid in the dorsum of his foot, which had distorted its shape. His skin was sensitive and prone to blistering, and he had previously experienced skin loss and skin breakdown. His calf circumference measured over 65 cm but there was minimal oedema above the knee. There was pitting and the subcutaneous skin had thickened.

The patient was prescribed a custom-fit, flat-knit, RAL compression class 4 (super) (60–90 mmHg) knee-high garment, a custom-fit, short-stretch footpiece and a legpiece wrap compression system (30–40 mmHg) to wear over the top. These were worn 24 hours per day. In addition, the patient underwent multiple courses of decongestive lymphatic therapy (DLT) comprising multilayer lymphoedema bandaging, which is applied daily in clinic over a period ranging from 2 to 4 weeks.

The patient initially wore the wrap compression system for 6 weeks as directed, but then reduced it to daytime wear only as he found it too hot at night. He continued receiving intensive DLT for the next 5 years. Each episode significantly reduced the volume of oedema and improved the shape of his leg and foot, thereby increasing his mobility, but these effects were short lived (6–12 months).

The patient attended follow-up assessments every 4–6 weeks between these courses of DLT. At a follow-up assessment in January 2017, it was observed that the limb volume had increased in size, although the skin was in excellent condition. It was decided to add a custom-fit, night-time compression garment (JOBST Relax) to the patient's therapy in an attempt to reduce the oedema before the next course of DLT. The patient was supplied a beige below-knee garment in compression class 2 (20–30 mmHg) and advised to wear it at night-time after removing his 'day' garments. The patient very much liked the look of the garment. He commented on how cool it was, and that he found it so comfortable that he often forgot he was wearing it.

After one week, the volume of oedema in his left lower leg had reduced (*Table 1*). It continued to reduce for 4–6



Fig 1. JOBST Relax in place

weeks. This was the first time this outcome had been achieved for this patient without DLT. However, it became apparent that he was wearing the wrap compression system over the top of the JOBST Relax compression class 2 garment at night. The patient explained that he did not feel that the JOBST Relax garment provided enough compression on its own, and he believed that it was the combined use of the two garments that had reduced his oedema. Interestingly, he did not experience any sensation of increased warmth or heat, as he had done previously when wearing the wrap compression system on top of the custom-fit, flat-knit compression garment. It was not intended that the patient should use JOBST Relax and the wrap compression system in this way. The fact that the

**Table 1. Reduction in limb volume achieved while wearing a JOBST Relax garment in compression class 2 (20–30 mmHg)**

Unit of measurement (ml)	Time period
18 238	Before using JOBST Relax
17 395	After 1 week's therapy
16 750	After 1 month's therapy
14 623	After 4–6 weeks' therapy

patient did this without instruction, illustrates how each patient with lymphoedema poses a unique challenge.

At the time of writing, the patient has been made aware that he no longer requires frequent and time-consuming courses of DLT, which will significantly improve his quality of life. He has said he would recommend the garment to other patients and would use on its own if it were available in a higher class (JOBST Relax is currently only available in a compression

class 1 (15–20 mmHg) or class 2 (20–30 mmHg) for the lower limb). Finally, it was noted that the garment supplied correlated extremely well with the measurements recorded on the measurement form. This ensures that the garment fitted well.

International Society of Lymphology (2013) The diagnosis and treatment of peripheral lymphedema: 2013 Consensus Document of the International Society of Lymphology. *Lymphology* 46(1): 1–11

## PATIENT WITH LYMPHOEDEMA IN A PALLIATIVE CARE SETTING

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**T**his case study describes a 68-year-old woman with a 12-year history of secondary lymphoedema in her right arm following a wide local excision and axillary node clearance for breast cancer. In January 2016, she was diagnosed with stage 4 breast cancer. A CT scan showed metastases in the skin, axilla and brachial plexus, plus more distant secondary sites.

She was adherent with self-management techniques such as simple lymphatic drainage, exercise, weight control (her body mass index was 29) and skin care. The patient had stage I lymphoedema according to the International Society of Lymphology (ISL) standards (ISL, 2013), which is indicative of mild lymphoedema. She wore a ready-to-wear, size IV, RAL compression class 1 (15–21 mmHg) circular-knit garment for approximately 10 hours during the daytime each day. Her excess limb volume ranged from 8.8% to 10%, and there was soft tissue on the proximal and distal part of her arm.

These measurements remained stable until June 2016 when, due to the locally invasive nature of her cancer, she gradually developed a severe swelling in her right arm and hand. This was complicated by a paralysis of her arm caused by the metastasis in the brachial plexus, which resulted in limb dependency. The excess volume of her right arm increased from 10% to 90%. This was partly due to the pain, which had prevented her from wearing her usual compression garment, her oral corticosteroid therapy, which had caused disseminated peripheral oedema, and loss of the skeletal-muscle pump function due to the paralysis.

Until her death in May 2017, the patient's treatment programme comprised decongestive lymphatic therapy, which included manual lymphatic drainage, multilayer

lymphoedema bandaging (MLLB) using cotton short-stretch bandages and custom-fit, flat-knit graduated compression garments reducing from RAL compression class 2 (23–32 mmHg) to compression class 1 (15–21 mmHg) as her ability to tolerate compression waned. She also tried using a wrap compression system glove and armsleeve. Eventually, she was unable to tolerate even light palliative bandaging with elasticated viscose stockinette and padding. She said that she 'hated' the size of her arm, the feeling of heaviness and the sight of the bandages, all of which reminded her of her diagnosis. She even said she would prefer amputation to further treatment.

When JOBST Relax became available, it was decided to evaluate the garment on the patient in April 2017. The use and cost of the garment was raised with the clinical lead, who responded, 'how can you place a cost on a treatment that might help to palliate a terminally ill patient when all other avenues have proved to be unhelpful?' An advanced nurse practitioner therefore measured the patient and ordered the garment. BSN medical were informed that the patient was receiving palliative care at home, and delivered the garment within the usual delivery time for this garment of 5 working days. After the fitting, the patient said that she found the garment 'tolerable'. Objective measurements and photographs were not taken as these were considered invasive and unnecessary at this stage. However, it is of interest that the patient was able to wear the garment for between 2 and 6 hours most days and derived some support from it, finding it comforting; the word she used was 'soothing'.

The lymphoedema service has since used JOBST Relax on two other palliative patients, both of whom found it easy to use, restful and supportive.

# PATIENT WITH BREAST CANCER-RELATED LYMPHOEDEMA AND A PAINFUL, PITTING ARM

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This case study describes a 61-year-old woman with a history of diverticular disease and breast cancer of the left breast, for which she underwent mastectomy and axillary lymph node clearance, followed by chemotherapy and radiotherapy. Postoperatively, she developed an encapsulated seroma on her left chest wall and axilla which, despite drainage, never fully resolved. Her medications comprised anastrozole, pregabalin, haloperidol, naproxen and omeprazole.

During a routine follow-up, the oncology team referred the patient to the lymphoedema service. Initial assessment revealed breast cancer-related lymphoedema in the left upper arm, which had been present for 2 weeks. There was swelling in the anterior chest wall, across the mastectomy scar line and in the

post-axillary pouch. The patient also had pins and needles in her left hand, a dull aching in her upper arm and a sharp pain in her axilla.

Moisture meter readings of the trunk were normal, but perometry readings of the upper limbs revealed mild lymphoedema (less than 20% excess limb volume) (Lymphoedema Framework, 2006). The patient's treatment plan comprised skin care, exercise and a ready-to-wear, circular-knit compression class 2 (23–32 mmHg) combined armsleeve. She was also prescribed a course of manual lymphatic drainage (MLD) to relieve the discomfort in her axilla.

When the patient attended the clinic one month later for MLD, the subcutaneous tissues had thickened throughout the left arm and erythema was present over the entire underside area of her upper arm. Although there was a blister where the top of the armsleeve had been rubbing, cellulitis was excluded as the patient was afebrile and feeling well. She was advised to continue with skin care and exercise, but the combined armsleeve was replaced with a custom-fit, flat-knit, compression class 2 (23–32 mmHg) combined armsleeve (with gauntlet). Following discussion, she also agreed to undergo 2 weeks of sequential pneumatic compression (SPC) at home.

At the patient's next consultation in clinic 2 weeks later, assessment revealed that her arm had become more oedematous and painful, and the tissues were firmer. In addition, there was pitting on her wrist and forearm. SPC was discontinued and MLD was resumed, which now included the arm as well as the trunk. She continued with the skin care and exercise, and wore the custom-fit, flat-knit combined armsleeve.

There was no particular reason why this treatment regimen was not effective, but the presence of the seroma on the anterior chest wall was unusual and might have contributed in some way.

Decongestive lymphatic therapy (DLT) comprises skin care, exercise, MLD and reduction/reshaping of the limb, usually using multilayer lymphoedema bandaging. This intensive treatment typically lasts for 2–4 weeks and requires frequent visits to a clinic. Due to personal circumstances and family commitments, which involved caring for her mother with dementia and supporting her daughter who had a young baby, the patient declined



Fig 1. JOBST Relax in place at one-week follow-up

**Table 1. Comparative measurements (before and after one week's therapy with JOBST Relax)**

Location (measurement point)	Before using JOBST Relax (cm)	One week after wearing JOBST Relax (cm)
A Hand	19.0	18.0
B Hand	21.0	20.5
C Wrist	19.0	19.0
C1 Wrist	20.0	20.0
D Forearm	27.5	25.5
E Elbow	30.5	29.0
F Upper arm	35.3	32.5
G Top of arm	39.0	33.0

DLT. Instead, she attended the lymphoedema clinic once a month for MLD. Keen to try a new product that might help her lymphoedema, in January 2017 she was fitted with a JOBST Relax custom-fit, compression class 1 (15–20 mmHg) combined armsleeve and gauntlet garment (at present, JOBST Relax is only available in compression class 1 for the upper limb) to be worn at night.

Within one week, almost all of the patient's circumferential measurements at the custom-fit measurement points had reduced, with a significant reduction of 6 cm at the top of the arm (*Table 1*). The tissues were softer due the micro-massaging effect of the garment and her arm felt much more comfortable.

The patient commented that the new garment looked expensive, and that she loved its colour (rose pink). She valued having a garment that was supplied in its own bag and stated that she wanted to take care of it. She washed the garment several times, as she felt it needed to return to its original shape and size, and commented that it washed well. She found the garment very light

and comfortable at night, and not hot as anticipated.

JOBST Relax armsleeves are available with and without a zipper: the patient had a sleeve without the zipper, and required some assistance to don it. In hindsight, a garment with a zipper might have been more appropriate.

Following one week's therapy with JOBST Relax, MLD no longer needed to be prescribed as the subcutaneous tissues remained soft and the reduction in limb volume was sustained. At the time of writing, the patient was wearing a custom-fit, flat-knit compression class 2 (23–32 mmHg) combined armsleeve with gauntlet during the day and her JOBST Relax combined armsleeve at night-time. She continues to perform her own skin care and is extremely active.

JOBST Relax has avoided the need for DLT, which requires a significant commitment from both the patient and the lymphoedema service in terms of time and resources.

*Lymphoedema Framework (2006) Best Practice for the Management of Lymphoedema. International Consensus. MEP, London*

## STRATEGY FOR MAINTAINING THE EFFECTS OF DECONGESTIVE LYMPHATIC THERAPY

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In October 2013, a 43-year-old woman with left sided breast cancer developed lymphoedema in her left arm following a radical mastectomy and axillary node clearance. She underwent radiotherapy and chemotherapy,

followed by long-term treatment with trastuzumab. She was also diagnosed with secondary tumours in her brain, which were treated with radiotherapy and steroids but, unfortunately, she required palliative care.

In early 2015, the patient was referred to the lymphoedema service, where an initial assessment identified mild lymphoedema (International Society of Lymphology (ISL) stage II (ISL, 2013)) in multiple sites: hand, arm and chest wall. She also had swelling in her head and neck due to oral steroids. She was measured for a RAL compression class 1 (15–21 mmHg) combined armsleeve and glove, and underwent a course of manual lymphatic drainage (MLD). The lymphoedema remained stable until she had a further course of chemotherapy in 2015 and developed cellulitis in her left arm. The size of her left arm increased, and was now 59.9% larger than her right arm (a total difference of 1388.8 ml). As the lymphoedema was now moderate to severe, intensive treatment was required (Lymphoedema Framework, 2006). As the main aim was now to reduce both the limb size and the risk of further episodes of cellulitis, the patient underwent a 2-week course of decongestive lymphatic therapy (DLT), which is a combination of MLD, multilayer lymphoedema bandaging, skin care and exercise.

Following this, the excess limb volume reduced to 35%. The patient was fitted with a custom-fit, flat-knit RAL compression class 2 (23–32 mmHg) combined armsleeve and glove to wear during the day, as well as a ready-to-wear arm wrap compression system (20–30 mmHg) and a ready-to-wear, circular-knit compression class 1 (15–21 mmHg) glove for use at night. After 3 weeks, the excess limb volume had reduced to 32%.

The patient adhered to her self-management regimen, which included skin care, exercise, simple lymphatic drainage (SLD) and both daytime and night-time use of compression garments and a wrap compression system. On examination she had soft, non-pitting lymphoedema in her left arm and hand. There were no signs of swelling in her head and neck, her chest wall lymphoedema had remained stable due to simple lymphatic drainage (SLD), and she had not experienced any episodes of cellulitis in the past 8 months.

In a routine 12-week post-DLT follow-up appointment, the upper aspects of her hand and forearm had mild, soft pitting oedema, but the limb volume had remained stable. However, she had usually removed the night garment and wrap compression system during the night as she found them warm and uncomfortable.

JOBST Relax is made from low-profile material, making it lightweight and slim. Furthermore, it contains Coolmax® yarn, which the manufacturer states has a cooling effect. The Macmillan lymphoedema advanced practitioner considered prescribing this night-time garment for the patient, but was concerned it was more expensive than the wrap compression system and glove. She was unsure how it would fit or, indeed, if it would benefit the patient as it was a new product. However, given the patient's comments, it was considered necessary to try an alternative garment.

The advanced practitioner therefore ordered a class 1 (15–20 mmHg) JOBST Relax custom-fit, combined armsleeve and gauntlet in rose; this has a similar compression level to the wrap compression system (20–30 mmHg). The garment arrived quickly (7 days)

and, following application, the patient immediately commented how comfortable it felt.

Seven days later, the advanced practitioner telephoned the patient, who was very impressed with the garment, stating,

*'I am finding it very comfortable to wear. It is so easy to apply and my forearm and top of hand have started to softened slightly.'*

The patient also stated that she kept the garment on all night as it never felt warm. As she found it so comfortable, and it did not restrict her movement or feel bulky, she wore it during the day when she was at home relaxing. The patient continued her 'day' therapy, wearing her custom-fit, flat-knit combined armsleeve and glove during the daytime.

At the next follow-up, 6 weeks after the fitting, the patient stated that she was still very happy with the JOBST Relax. Her hand and forearm were now soft and non-pitting, and the excess limb volume had reduced by 10%, with a 22% difference to her non-affected arm. The patient was convinced that the night-time garment was the main reason for this reduction as it was the only change in her self-management regimen.

The patient was extremely delighted with these results as she was about to be a bridesmaid at her sister's wedding. The reduction in her limb volume made her feel more confident about this.

Due to the visible reduction in swelling achieved with the JOBST Relax garment, and the patient's preference for it, the advanced nurse practitioner subsequently ordered this garment for another two patients. She has found it very easy to measure for and easy to fit. In addition, delivery was prompt. Although the night-time garment is more expensive than a wrap compression system, the advanced practitioner has found it more cost effective as patients have been more likely to wear it, thereby promoting adherence with treatment. More importantly, in all three patients it has achieved a significant reduction in limb size, improved the condition of the skin and, due to its cooling effect, resulted in greater patient satisfaction.

International Society of Lymphology (2013) The diagnosis and treatment of peripheral lymphedema: 2013 Consensus Document of the International Society of Lymphology. *Lymphology* 46(1):1–11

Lymphoedema Framework (2006) *Best Practice for the Management of Lymphoedema. International Consensus*. MEP, London



# AVOIDING THE NEED FOR REPEATED DECONGESTIVE LYMPHATIC THERAPY

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**T**his case study describes a 59-year-old woman who was diagnosed in 2006 with left sided breast cancer. She initially declined treatment, but underwent a mastectomy in 2008. In 2011, following a diagnosis of recurrent disease to the scar line, she underwent a wide local excision and lymph node dissection. Histology reports showed that two of the seven nodes were positive. In March 2012, the patient underwent chest wall and axillary radiotherapy. Three years later,

she developed lymphadenopathy and swelling on the right side of her neck, and was diagnosed with further recurrence and superior vena cava obstruction (SVCO), which was stented. In 2017, pulmonary and liver disease progression was diagnosed, and in June 2017 she commenced second-line endocrine treatment with everolimus and exemestane

The patient's history of lymphoedema dated back to 2011 when she developed the condition in her left



Fig 1. The patient's arms on the first day of therapy with JOBST Relax

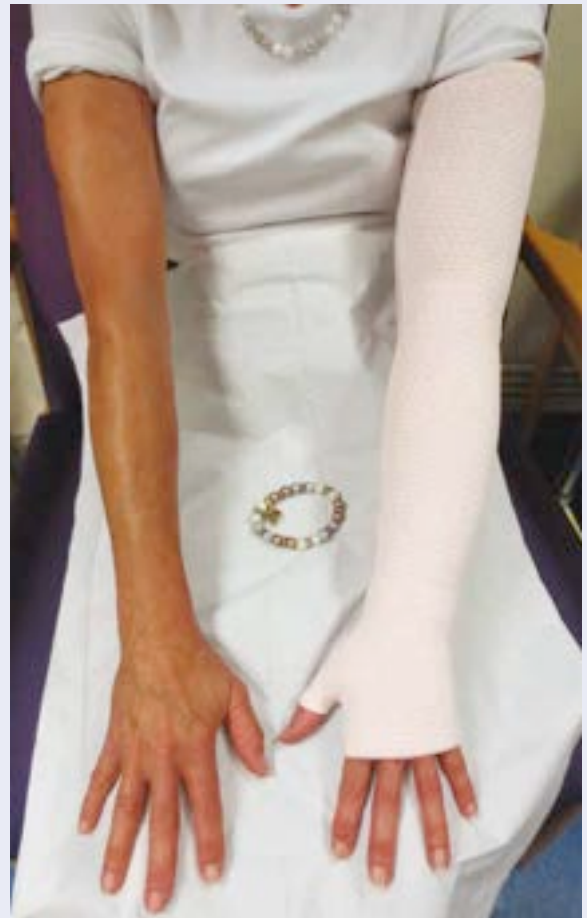


Fig 2. JOBST Relax in place

**Table 1. Limb volumes when JOBST Relax was fitted and at each follow-up**

Date	Left arm volume (ml)			Right arm volume (ml)			Excess limb volume (ml)
	Proximal	Distal	Total	Proximal	Distal	Total	
8 June 2017 (measured for JOBST Relax)	1177	827	2004	830	629	1459	545 (37%)
18 July 2017*	1005	805	1810	797	664	1461	349 (24%)
2 August 2017	1051	851	1902	831	705	1536	366 (24%)

\*JOBST Relax was fitted on 5 July, and these measurements were reported at the first subsequent assessment, 13 days later

wrist following axillary surgery. A health professional from the hospital prescribed an armsleeve (full details were not reported, but it is likely to have been a circular knit, ready-to-wear compression class 1 or 2 garment). At a follow-up in the radiology department, it was documented that she wore the armsleeve intermittently. In July 2015, following the insertion of stents for the SVCO, the swelling in her left arm increased. Her limb volume kept increasing and, in February 2016, she was

referred to her local lymphoedema service.

Between February 2016 and 6 April 2016, following daily wear of a ready-to-wear, circular-knit compression class 2 (20–36 mmHg) glove and 20–30 mmHg wrap compression system armpiece, the volume of her arm reduced by 384 ml, with the excess limb volume decreasing from 114% to 89%. However, at the next review 3 weeks later, this had increased by 399 ml, increasing the excess volume to 111%.



Fig 3. The patient's arms on the 10th day of therapy with JOBST Relax



Fig 4. JOBST Relax in place after 10 days of therapy

Her entire left arm was enlarged, and the digits and dorsum of her hand were bulging. The subcutaneous tissues were densely pitted and, while her skin was intact, it was extremely shiny and taught. The patient was struggling to put her clothes on, and was becoming increasingly self-conscious about her arm, saying it was affecting her relationship and mood. In addition, the heaviness and aching in her arm was preventing her from carrying out activities of daily living.

Circumferential limb measurements showed that the patient's left arm had an excess volume of 114% (1750ml). Lymphovenous oedema secondary to SVCO, with underlying secondary lymphoedema resulting from breast cancer surgery, were diagnosed.

In May 2016, the patient underwent a 2-week course of decongestive lymphatic therapy (DLT) comprising intermittent pneumatic compression and multilayer lymphoedema bandaging. Following this, the excess limb volume reduced to 47% (719 ml). She was fitted with a custom-fit, flat-knit RAL compression class 2 (23–32 mmHg) armsleeve and a custom-fit, flat-knit compression class 2 (23–32 mmHg) glove, and advised to wear them 24 hours a day for 6 weeks and thereafter during the daytime only.

At the 6-week follow-up, it was found that the distal forearm had refilled, with a 51 ml distal increase in the affected arm, and the tissues were firmer and non-pitting. However, the increase was thought to be partly due to the hot weather. Nevertheless, use of these garments alone had not been effective in maintaining the results of the DLT. The patient had been adherent with the compression therapy, and only occasionally wore the wrap compression system when her arm felt larger and she was unable to tolerate the armsleeve. She was keen to reduce the limb volume further, stating that her arm still did not feel 'normal'.

In April 2017, the patient started a second course of DLT, after which the excess limb volume reduced from 59% (953 ml) to 27% (429 ml). She was advised to continue the same maintenance regimen as before. However, following a discussion about JOBST Relax, she agreed to try it. When her limb was measured for the garment, it was found that her excess volume had increased to 37% (545 ml), despite her adherence with the standard maintenance regimen. The entire arm was enlarged, particularly in the distal region, but the tissues were soft and the skin was intact.

*Figure 1* shows the patient's arm on the day that JOBST Relax custom-fit, combined armsleeve and gauntlet (15–20 mmHg) was fitted, *Figure 2* shows the garment in place. *Table 1* gives the limb volumes. The

garment was a good fit, except for the thumb stall, which was a little too tight, and the top of the garment, which was slightly loose, although this might have been due to changes in the limb size that occurred between measuring and fitting.

The patient wore her compression garments everyday: she put on her day garment when she woke up and kept it on until 9.00pm. She then donned JOBST Relax and wore it until 5.30am. The JOBST Relax garment did not disturb her sleep. With the aid of an applicator, she was able to apply the night-time garment with ease. She found the garment comfortable and easy to care for and remove.

According to the patient, there were no significant changes in her limb size in the mornings, and her skin looked dimpled. *Figures 3 and 4* shows the arm after 10 days of therapy with JOBST Relax.

After 2 weeks of wearing JOBST Relax, the excess limb volume had reduced from 37% to 24% (*Table 1*). While the entire arm was still enlarged, the tissues had remained soft and the skin was still intact. Smaller garments were ordered for both daytime and night-time use. At the next follow-up, 2 weeks later, the reduction in volume had been maintained, and the tissues were still soft and the skin intact.

The patient considered that JOBST Relax had 'helped manage' her arm and that its looser proximal fit, when compared with her day garment, was beneficial: she also felt this has helped improved the shape of the top part of her arm.

At the last review to date, after 4 weeks of therapy with JOBST Relax, the patient felt that the results of DLT had been maintained in terms of limb size and the appearance and texture of the tissue. This compared well with the previously disappointing results of maintenance treatment after DLT reported at the 6-week follow up. Her forearm was generally soft, although on some days it became firmer, but the skin stayed intact and well hydrated. A bilateral increase in size was observed, but this was evenly distributed throughout the limb (ie, both distally and proximally) and the excess limb volume remained unchanged. As the patient reported that she had not gained any weight, this could not be attributed to weight gain.

JOBST Relax provided the patient with comfortable night-time compression, which in turn has facilitated better maintenance of intensive treatments. The cost of the garment is a fraction of that incurred by repeated courses of DLT, and its benefits lasted longer. Therefore, JOBST Relax is likely to be a useful addition to ensure better long-term outcomes for patients.





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# ARE YOUR PATIENTS COUNTING SHEEP?



Ask Ronnie Relax about the benefits of night compression in lymphoedema management

- Reduced swelling<sup>1</sup>
- Improved pain management<sup>1</sup>
- Comfort and sense of relief<sup>1</sup>

## JOBST® RELAX

### MORE THAN JUST A GOOD NIGHT'S SLEEP



Source 1: Whitaker, J (2016) 'Lymphedema management at night: views from patients across five countries', British Journal of Community Nursing, 21 (Sup10) pp. S22-S30

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# Evaluation of a novel night-time compression garment: a prospective observational study

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Lymphoedema is caused by the accumulation of lymph due to an imbalance between the production and transport of interstitial fluid. Although lymphoedema is not curable, it can be managed with manual lymphatic drainage, compression therapy, exercise and skin care (International Society of Lymphology, 2013). After completing an intensive initial treatment phase designed to reduce lymphoedema volume as much as possible, patients progress onto long-term maintenance (Toccafondi et al, 2017).

For many patients, the key outcome that they are aiming for is self-management. Those who establish routines for self-management can normalise life with lymphoedema and assume ownership of it, which will lead to improved control (Jeffs et al, 2016). Not surprisingly, empowering patients through the use of personalised treatment plans that encourage self-management is a standard of practice for lymphoedema services (International Lymphoedema Framework, 2006). Compression garments play a key role in the maintenance phase, although optimal results will depend on the patient's ability to adhere to and use them properly (International Society of Lymphology, 2013).

Although various compression garments for lymphoedema have been described in various articles (Nazarko, 2015; Wigg and Lee, 2015; Whitaker, 2016a), none of these refer to garments specifically designed for use at night (Whitaker, 2016b). In some patients, it is necessary to maintain continuous compression to prevent a recurrence of oedema (International Lymphoedema Framework, 2012). A study on patients with lymphoedema following breast cancer treatment revealed that failure during the maintenance phase is common. However, this risk is significantly reduced by combining day and night compression therapy (Vignes et al, 2011). Compression at night, such as in the form of self-bandaging, can supplement day-time compression.

Despite this, there is limited published evidence on the efficacy of night-time compression. A study involving 94 patients with chronic lymphoedema, most of whom had the condition in the leg (n=63, 67%), revealed the benefits of night-time compression, as well as several drawbacks and unmet needs (Whitaker, 2016b). However, most patients (n=84, 89%) experienced increased swelling overnight when they did not

wear night-time compression. The main reasons cited for not using compression at night included tiredness, increased sensation of heat and stable oedema. Patients who used night-time compression reported reduced swelling, improved pain management and better sleep (Whitaker, 2016b). Over 80% of patients using night-time compression experienced a maintained or reduced level of oedema. Despite these benefits, patients also indicated that night-time compression devices could be improved; suggestions included a device that felt less tight, did not slip or dig, did not feel hot at night and could be applied more easily (Whitaker, 2016b).

JOBST® Relax is a compression garment specifically designed for night-time use (Moffatt, 2017). (For the purposes

## ABSTRACT

This prospective, single-centre, observational study set out to evaluate the clinical performance and safety of JOBST Relax®, a custom-made compression garment, when worn by a series of patients with lymphoedema during resting hours and at night. Patients were recruited after undergoing complete decongestive therapy (CDT) and wore the night-time compression garment for 21 days as part of their compression therapy regimen. Questionnaires were used to capture their views on parameters such as the garment's comfort, ease of use, fit, ability to avoid excessive heat and perspiration, its effect on their quality of life and their overall satisfaction with it. Occurrences of erythema, skin rash, skin dryness and pain were also evaluated. Ninety-one patients completed the study. Most perceived the night-time compression garment to be 'very good' or 'good' in terms of its ease of use and comfort, its ability to control their oedema and its effect on their quality of sleep. The prevalence of erythema, skin rash, skin dryness and pain was reduced when compared with baseline. Patients also reported that the night-time garment reduced their dependence on others and improved their quality of life. Overall, most rated their satisfaction with the garment as 'very good' or 'good'. Patients reported a high level of satisfaction with both the garment and the comfort associated with it when wearing it frequently.

## KEY WORDS

◆ lymphoedema ◆ night-time compression garment ◆ quality of sleep ◆ self-management ◆ tolerability

of this article, it is referred to hereafter as the night-time compression garment.) It was formulated to address the patient complaints about night-time compression garments described by Whitaker (2016b). As it is a custom-fit and flat-knit garment, it stays in place and so maintains a consistent pressure gradient. Its textured surface is designed to induce a micro-massage effect and thus stimulate lymph flow. A monofilament spacer layer provides cushioning and can adapt to various sleeping positions. The night-time compression garment contains breathable Coolmax yarns that stop it from becoming too warm when the patient is sleeping (Whitaker, 2017). Several case studies, conducted in diverse clinical settings and published in a supplement, have provided preliminary clinical evidence on the clinical performance of and patient satisfaction with this night-time compression garment (British Journal of Community Nursing, 2017). The present study aimed to systematically assess the clinical performance and safety of the night-time compression garment during resting hours or at night in a larger sample of patients, all of whom had stage II arm or leg lymphoedema.

## Method

This was a prospective observational study conducted between November 2017 and May 2018 in a single clinic (Földiklinik GmbH & Co. KG) in Hinterzarten, Germany. Potential subjects were identified and recruited during regular clinic visits. Patients attending this clinic are advised to self-bandage at night, making this the predominant benchmark against which the effects of the night-time compression garment could be assessed.

## Ethics

The study was approved by the Freiburger Ethikkommission international ethics committee and conducted in accordance with the principles of the Declaration of Helsinki. All of the participants provided written informed consent to participate and were free to withdraw from the study at any time without giving a reason.

## Inclusion and exclusion criteria

Eligible patients were aged  $\geq 18$  years with stage II lymphoedema on the lower or upper extremities for which a daytime flat-knitted compression garment was indicated. To be included, they had to have received inpatient treatment at the clinic and have progressed to the maintenance phase; they also required experience with daytime compression therapy on the affected extremity (previous wearing period was 5 days per week,  $\geq 6$  hours per day), and had to be willing to wear the night-time garment at least 5 days per week. Finally, they had to be physically and mentally able to participate in this study and to provide written informed consent.

Exclusion criteria were: arterial insufficiency; deep vein thrombosis; decompensated heart insufficiency or acute heart failure; untreated cancer; very deep skin folds; untreated septic phlebitis; phlegmasia cerulea dolens (severe form of deep venous thrombosis); missing or very impaired or severe peripheral neuropathy; a known sensitivity to one or more night-time compression garment's components.

## Study protocol

Four study visits were required, involving four appointments. First, patients provided written informed consent, after which they completed a questionnaire which enquired about the compression garments they had used previously and the duration/type of lymphoedema present. They were then measured for the custom-made night-time compression garment, which they received 2–3 days later, when they were shown how to apply it. As proper fit and handling of the compression garment are critical, the medical staff at the clinic carefully assessed that it fitted properly. The observation period of 21 days began at this point. At  $\pm$ day 21 after the first application of the garment, each patient completed a second questionnaire that enquired about the garment's performance, its safety parameters and their satisfaction with it, and elicited lymphoedema-specific data on their quality of life (QoL). The QoL questions were based on validated tools (Keeley et al, 2010), although it should be noted that the questionnaire was not designed to achieve a comprehensive assessment.

## Performance and safety criteria

After the 21-day observation period, the patients assessed the performance and safety of the night-time compression garment using Likert and similar rating scales. Performance criteria included fit, wearing comfort, heat, perspiration, quality of sleep, effect on daytime compression in the morning, patient satisfaction with the garment and lymphoedema-specific QoL. Safety criteria included the presence of skin erythema, rash, dryness, itching, unpleasant pressure marks and pain. Patients also reported wearing times. No comparative measurements were undertaken during the follow-up period.

## Data analysis

Data were analysed by an independent consultant (<http://www.econ-epi.eu/>, ECON-EPI, Hamburg, Germany). Continuous variables were described as the absolute number of observations and mean  $\pm$  standard deviation ( $\pm$ SD). Percentages and frequencies were used to describe nominal or ordinal variables.

## Results

A total of 94 patients were recruited into the study. Two patients withdrew from it (one withdrew consent and the other did not receive the garment in time). One patient was aged under 18 years and so were excluded. Therefore, 91 patients were included in the analysis.

## Baseline patient demographics and disease characteristics

The majority of the sample ( $n=79$ , 86.8%) were female. Mean ( $\pm$ SD) age was 57 ( $\pm 13.9$ ) years. Mean ( $\pm$ SD) duration of lymphoedema was 11.5 ( $\pm 10.0$ ) years. The majority of patients ( $n=62$ , 68.5%) had secondary lymphoedema, mostly in their legs (Table 1).

## Previous use of compression

Eighty-nine patients (97.8%) had worn day-time compression before entering the study. They had been wearing

day-time compression for a mean ( $\pm$ SD) duration of 10.5 ( $\pm$ 9.2) years. Compression garments were worn predominantly during the day. As stated above, patients who attended the Földi Clinic were advised to self-bandage at night. A total of 42 patients (46.2%) had worn night-time compression previously for a mean duration of 9.7 ( $\pm$ 7.9) years. Of these patients, 21 (50%) wore compression at night at least three times/week, seven (16.7%) wore it less than three times/week and 13 (31%) wore it irregularly. Self-bandaging was the predominant method of compression worn at night time ( $n=34$ , 81%) (Table 2).

### The night-time compression garment

During the observation period, patients wore the night-time compression garment for a mean ( $\pm$ SD) of 24.5 ( $\pm$ 9.1) days (range: 19–72). All patients wore it on most nights each week (6.5 $\pm$ 0.8 nights/week) for 7.9 ( $\pm$ 0.9) hours per night. Fifty-two patients (57.1%) also wore the night-time compression garment during resting hours in the evening for 5.3 ( $\pm$ 1.7) days per week, as well as for 2.6 ( $\pm$ 1.3) hours per day (Table 3).

### Ease of use and comfort

Patients rated the garment's ease of use and comfort highly. Fit, wearing comfort and breathability were deemed 'good' or 'very good' by at least 86 patients (94.5%). Appearance, donning and doffing were rated as 'good' or 'very good' by at least 77 patients (85%). The full results are given in Figure 1. Only 30 patients (33%) used a donning aid.

Twenty-five patients reported applying body lotion before donning the garment. None of these patients said that the lotion affected the garment (data are missing for two patients) (Table 3).

### Sensation of heat and perspiration

Seventy-eight patients (85.7%) and 79 patients (86.8%) rated the night-time compression garment as 'good' or 'very good' in terms of avoiding heat generation and perspiration, respectively. Full results are given in Figure 2. Only six patients (6.6%) occasionally removed the garment at night because of a sensation of heat and perspiration.

### Tolerability

The night-time compression garment was associated with a marked reduction in the occurrence of erythema on the skin compared with baseline. More patients did not experience erythema when wearing the night-time compression garment ( $n=75$ , 82.4%) compared with before the study ( $n=21$ , 23.1%). In addition, there were notable reductions in the prevalence of skin rash, skin dryness and pain during the study period (Table 4). Most patients did not experience itching ( $n=70$ , 76.9%) or pressure marks ( $n=78$ , 85.7%) while wearing the night-time compression garment (Figure 3) (no baseline data were collected on these parameters).

### Quality of sleep

Patients rated their quality of sleep while wearing the night-time compression garment on a five-point scale ranging from 'very good' to 'very poor.' Eighty-nine patients (97.8%)

**Table 1. Demographic data and lymphoedema-specific parameters**

	Total sample (n=91)
Female	79 (86.8%)
Age (years), (mean $\pm$ SD)	57.0 $\pm$ 13.9
Duration of lymphoedema (years) (mean $\pm$ SD)	11.5 $\pm$ 10.0
<b>Type of lymphoedema</b>	
◆ Primary	25 (27.5%)
◆ Secondary	62 (68.5%)
◆ Obesity-associated	2 (2.2%)
<b>Location of lymphoedema (affected extremity)*</b>	
◆ Right leg	36 (39.6%)
◆ Left leg	48 (52.7%)
◆ Right arm	11 (12.1%)
◆ Left arm	16 (17.6%)
<i>All values are n (%) unless otherwise indicated</i>	
<i>* Some patients were affected on more than one location</i>	

**Table 2. Patients' previous experience with day and night-time compression**

	Total sample (n=91)
<b>Used day-time treatment before entering the study</b>	
<b>89 (97.8%)</b>	
◆ Years of daytime treatment (mean $\pm$ SD)	10.5 $\pm$ 9.2
◆ Type of day-time treatment used previously:*	
◆ Compression garment	89 (100.0%)
◆ Self-bandaging	13 (14.6%)
◆ Other type of daytime treatment	0 (0.0%)
<b>Used night-time treatment before entering the study</b>	
<b>42 (46.2%)</b>	
◆ Years of night-time treatment (mean $\pm$ SD)	9.7 $\pm$ 7.9
◆ Wearing behaviour:**	
◆ At least three times a week	21 (50.0%)
◆ Less than three times a week	7 (16.7%)
◆ Irregularly (no wearing routine)	13 (31.0%)
◆ Type of night-time treatment used previously:*	
◆ Compression garment	11 (26.2%)
◆ Self-bandaging	34 (81.0%)
◆ Other type of day-time treatment	4 (9.5%)
<i>* Patients supplied more than one answer</i>	
<i>** Data are missing for one patient, thereby reducing this subset to 41 patients</i>	

reported that their quality of sleep was either 'very good' or 'good' when wearing the garment at night (Figure 4). Eighty-six patients (94.5%) stated that, compared with what they had experienced before first wearing it, the quality of the sleep associated with the night-time compression garment was 'very good'/'good' (Figure 4). Most patients ( $n=82$ , 90.1%) described their ability to handle their day compression the next morning as 'very good'/'good' (Figure 4).

A subgroup analysis was performed on the 42 patients who had worn night-time compression before entering the study. Of these, 41 (97.6%) said the quality of sleep experienced with the night-time compression was 'very good' or 'good' compared with what they had experienced with their previous night-time product.

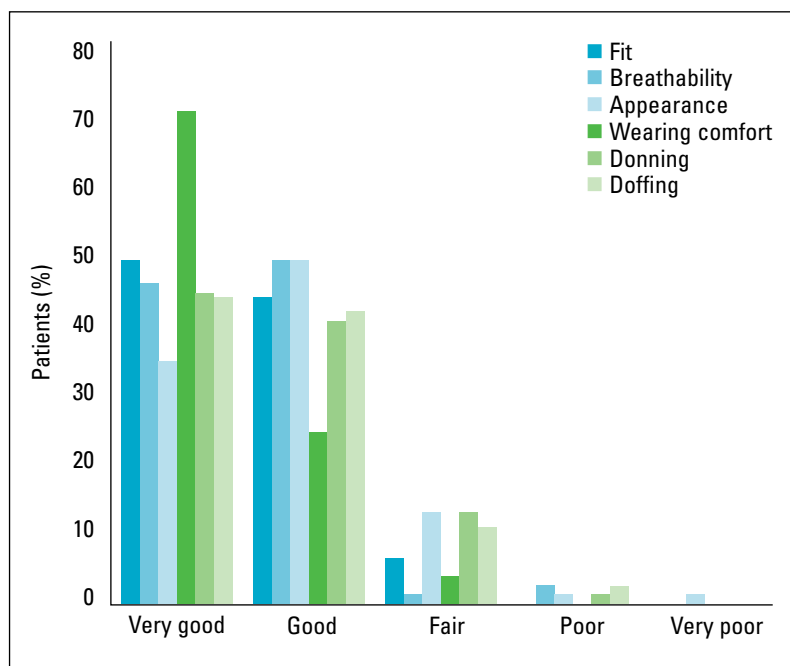


Figure 1. Patients' perspectives on the properties of the night-time garment and its ease of use

Table 3. Wearing periods and habits associated with the night-time compression garment

	Total sample n=91
Wearing period (days) of the night-time garment*	24.5±9.1
No. of nights the garment was worn each week**	6.5±0.8
No. of hours the garment was worn each night**	7.9±0.9
Styles of night-time compression garment:	
♦ Arm garment with hand	22 (24.2%)
♦ Arm garment without hand	1 (1.1%)
♦ Knee-high garment	4 (4.4%)
♦ Thigh-high garment	64 (70.3%)
Compression class:	
♦ Class 1 (15–20 mmHg)	23 (25.3%)
♦ Class 2 (20–30 mmHg)	68 (74.7%)
Use of the night-time during resting hours: §,	
♦ Yes	52 (57.1%)
♦ No	31 (34.1%)
No. of patients who wore the night-time garment during resting hours:  .^	52 (57.1%)
♦ Days per week	5.3±1.7
♦ Hours per day**	2.6±1.3
Use of body lotion before donning the night-time garment:	25 (27.5%)
♦ Changes in product characteristics if body lotion was used: &	
♦ Yes	0 (0.0%)
♦ No	10 (40.0%)
♦ No recognised changes	13 (52.0%)

All values are mean±SD unless otherwise indicated.  
 \* Data are missing for one patient  
 \*\* Data are missing for one patient from each category  
 § Data are missing for eight patients  
 | Resting hours were in the evening while the patient was awake  
 ^ Data are missing for one patient  
 & Data are missing for two patients

Of the entire sample, 69 patients (75.8%) reported that the night-time compression garment helped managed their oedema 'a lot' or 'a great deal'. Of the subgroup of 42 patients who had worn night-time compression products before entering the study, 33 (78.6%) reported that the current night-time compression garment helped manage their oedema 'a lot' or 'a great deal'; 26 of these patients (61.9%) reported that the previous night-time product had improved their oedema to the same degree (Figure 5). Most of the patients in this subgroup (34, 81.0%) had self-banded before entering the study.

Effect on quality of life

The night-time compression garment had a positive impact on disease-specific QoL parameters, compared with baseline. The largest improvement related to the overall effect of lymphoedema on QoL: 49 patients (53.8%) reported that the disease affected them 'a lot' or 'a great deal' at baseline, compared with 38 patients (41.8%) at the study end. Similarly, the percentage who reported they were 'not at all dependent' on others for support because of their lymphoedema increased from a baseline of 36% to 51% at the end of the study. There was also a reduction in the percentage of patients who felt 'a lot' or 'a great deal' of unattractiveness due to lymphoedema (48% at baseline vs. 41% at end of study) (Table 5).

Overall patient satisfaction

Eighty-six patients (94.5%) rated the night-time compression garment as 'good' or 'very good'. Only one patient rated satisfaction as 'fair' and one patient as 'very poor' (Figure 5). This patient was used to wearing very strong compression during the day as a result of combining a class 2 and a class 3 compression garment.

Discussion

These results demonstrate the performance and tolerability of the night-time compression garment. Most of the patients commented that the new garment was comfortable, easy to use and more tolerable than the product(s) they had worn before entering the study. In addition, patients experienced a good quality of sleep during the observation period, and the quality of sleep they reported at the end of the study had improved when compared with that experienced before its start. Disease-specific QoL also improved when compared with baseline, and, based on the questionnaire, was associated with a reduced dependence on others. Importantly, patients who had worn night-time compression previously commented that their oedema was better controlled compared with the period before they entered the study.

In the author's experience, patients with lymphoedema are non-adherent to night-time compression therapy. It is possible that this is due to the discomfort and inconvenience of night-time compression products (Whitaker, 2016b). In this study, the entire sample wore the night-time compression for means of 6.5 days per week and 7.9 hours per night. Patient adherence to the night-time compression garment was therefore higher than would be expected for compression bandages. This was probably due to the better tolerability and comfort observed with the garment.

Due to the time required to apply compression bandages, patients with lymphoedema who might benefit from night-time compression may choose not to wear it. In the author's experience, it takes trained and experienced patients approximately 45 minutes to apply and doff (including rolling up the bandage the next morning) a single leg, increasing to 90 minutes for both legs. It takes an experienced patient 25 minutes to self-bandage an arm. In contrast, the investigator observed that patients were able to don the night-time compression garment within 1–2 minutes.

Drawbacks with other night-time compression garments reported by patients include discomfort, skin reactions and a sense of heat or perspiration (Whitaker, 2016b). In the author's experience, many patients experience an intense feeling of heat under a compression garment when wearing it in bed, resulting in them taking it off. In this study, very few patients reported skin reactions with the night-time compression garment when compared with baseline. Only six (7%) removed the garment due to heat or perspiration (on some days).

Some patients experience sleep disturbance when wearing compression products at night (Whitaker, 2016b). In this study, patients reported that the quality of their sleep was 'good' or 'very good' when wearing the night-time compression garment, and indicated that it had improved when compared with baseline.

Many patients reported a major improvement in their lymphoedema in the next morning. According to the investigator, this was mostly characterised by a reduced sensation of tension and heaviness in the affected limb, although this was not measured. Patients with leg lymphoedema subsequently found it much easier to put their shoes on. It is worth noting that night-time compression in general will have this effect (Whitaker, 2016b). The key factor influencing adherence to a night-time compression garment is comfort. Patient adherence to self-bandaging before going to bed can be very poor.

Patients who had never worn compression at night stated that, due to the good wearing comfort experienced with the night-time compression garment and the short time required to don it, they would consider wearing it when resting and at night. Taken together, the garment's convenience and tolerability may improve patient adherence to night-time compression therapy.

This study has several limitations. Patients were recruited after completing decongestive lymphatic therapy and thus constituted a homogenous patient population that was

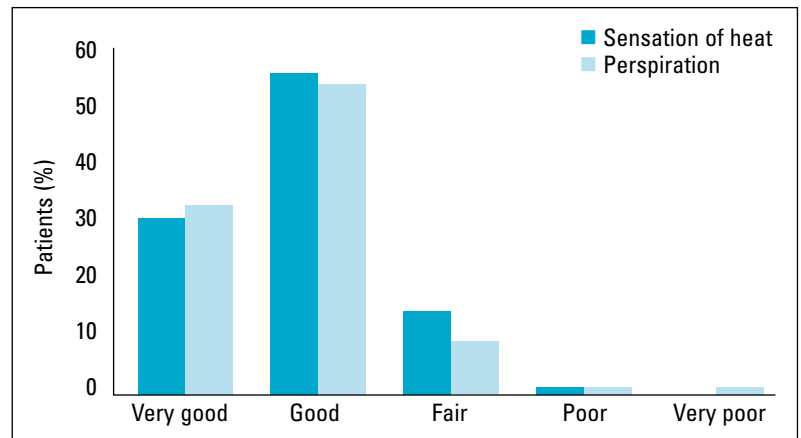


Figure 2. Patients' perspectives on the ability of the night-time garment to avoid sensation of heat and perspiration at night

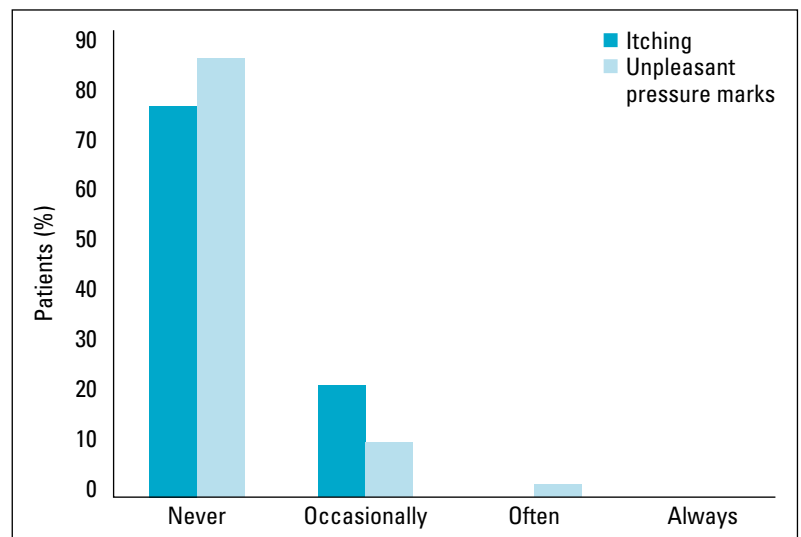


Figure 3. Occurrence of itching and unpleasant pressure marks observed with the night-time garment

optimally decongested and had limited complications, which positively influenced their QoL. However, these factors are a prerequisite for assessing parameters such as comfort, fit and quality of sleep, as patients with uncontrolled oedema may have difficulties in specifically assessing the performance of their compression garment. Another limitation is the study's non-comparative design, as the night-time compression garment was not directly compared with any other products that

**Table 4. Occurrence of lymphoedema-specific problems with compression garments**

	Baseline data				End of evaluation			
	Never	Occasionally	Often	Always	Never	Occasionally	Often	Always
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Erythema	21 (23.1)	47 (51.6)	17 (18.7)	6 (6.6)	75 (82.4)	14 (15.4)	0 (0.0)	2 (2.2)
Skin rash*	53 (58.2)	32 (35.2)	4 (4.4)	0 (0.0)	87 (95.6)	4 (4.4)	0 (0.0)	0 (0.0)
Skin dryness**	12 (13.2)	40 (44.0)	24 (26.4)	13 (14.3)	62 (68.1)	24 (26.4)	2 (2.2)	1 (1.1)
Pain	23 (25.3)	47 (51.6)	18 (19.8)	3 (3.3)	84 (92.3)	6 (6.6)	1 (1.1)	0 (0.0)

\* Baseline data are missing for one patient  
 \*\* Baseline and endpoint data are missing for two patients

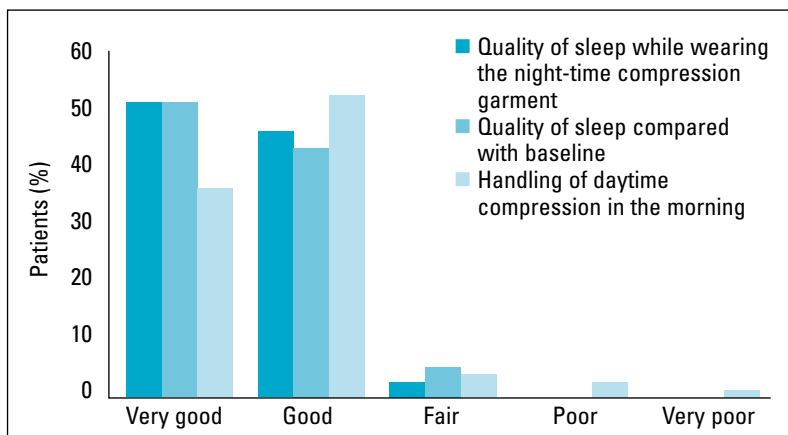


Figure 4. Patient self-reported quality of sleep while wearing the night-time garment and compared with that for the night-time compression worn before entering the study, as well as ability to handle daytime compression in the morning after wearing the night-time compression garment during the study

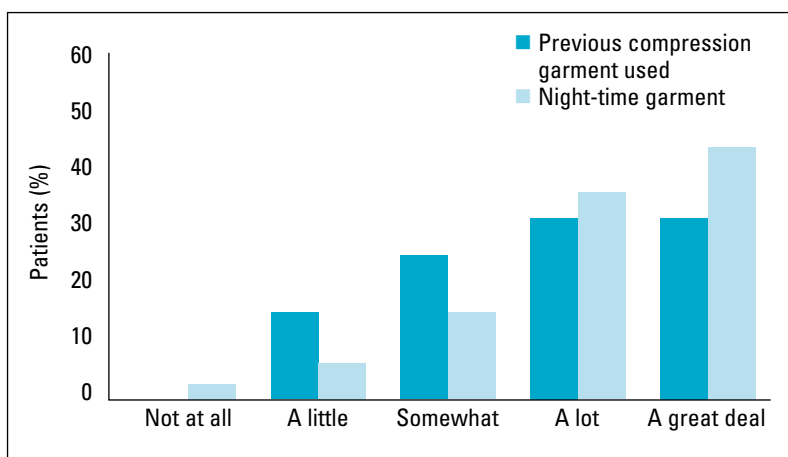


Figure 5. Patient self-reported rating of the ability of the night-time compression garment to control oedema compared with baseline (n=42, this is the subgroup of patients who wore compression at night before entering the study)

can be used to achieve compression at night. It is also possible that there were other reasons, beside the use of the garment, for the improvements observed in lymphoedema-related QoL.

Patients' self-reported outcome and wearing times and were not assessed by a health professional at the end of the follow-up period. This was due to practical reasons as the patients do not live near the specialist centre and repeat visits would be costly and inconvenient for them. This is a general issue affecting other studies in lymphology. Generally, patients visit their lymphoedema specialist once a year.

Future research should focus on comparing the night-time compression garment with the most common alternative night-time compression regimen (self-bandaging) and note the effects on QoL. Data collection that allows health economic modelling would also be useful.

### Conclusion

This study demonstrated that the night-time compression garment was well tolerated by this patient sample, who found it comfortable and conducive to sleep. Due to its ease of use and tolerability, the garment appears to improve adherence to night-time compression for lymphoedema and increase patients' ability to self-manage this condition. This can potentially improve both patient outcomes and quality of life.

*Conflict of interest: this article was supported by BSN medical, who provided MA Healthcare with financial support to help prepare the article for publication*

*Acknowledgements: the author would like to thank Dr. Martha Földi for supporting the study, the patients who participated in the study, the Földi clinic team and Monika Albers and her team at the medical supply shop Hinterzarten, ECON-EPI for the data management and BSN medical for coordinating the study and providing the night-time compression garments.*

	Baseline					End of the evaluation				
	Not at all	A little	Somewhat	A lot	A great deal	Not at all	A little	Somewhat	A lot	A great deal
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Lymphoedema affected the patient's quality of life*	1 (1.1)	14 (15.4)	26 (28.6)	22 (24.2)	27 (29.7)	2 (2.2)	19 (20.9)	30 (33.0)	23 (25.3)	15 (16.5)
Dependence on others for help due to the lymphoedema**	33 (36.3)	32 (35.2)	15 (16.5)	6 (6.6)	4 (4.4)	46 (50.5)	21 (23.1)	13 (14.3)	7 (7.7)	4 (4.4)
Unattractiveness due to lymphoedema§	9 (9.9)	14 (15.4)	22 (24.2)	21 (23.1)	23 (25.3)	12 (13.2)	21 (23.1)	20 (22)	20 (22)	17 (18.7)

\*Baseline and endpoint data are missing for one and two patients, respectively  
 \*\*Baseline data are missing for one patient  
 § Baseline and endpoint data are missing for two and one patients, respectively

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## KEY POINTS

- ◆ Lymphoedema is a condition characterised by swelling caused by accumulation of lymph
- ◆ While no curative treatment exists for lymphoedema, the condition can be managed with complex decongestive therapy including manual lymphatic drainage, compression therapy and exercise and skin care
- ◆ Optimal therapy outcomes can be achieved by combining day and night-time compression
- ◆ Patients may not adhere to night-time compression regimens due to difficulties or discomfort with currently-available compression garments
- ◆ JOBST® Relax is a compression garment specifically designed for night-time use and is effective and well-tolerated

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## CPD REFLECTIVE QUESTIONS

- ◆ Are your lymphoedema patients aware of the importance of night-time compression in managing their condition?
- ◆ Do your lymphoedema patients consistently use night-time compression?
- ◆ For your patients who do not use night-time compression consistently, what are the reasons for this lack of therapy adherence?



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# An innovative flat-knit compression garment for lymphoedema patients led to better outcomes: a multicentre study

**Objective:** To evaluate the clinical performance, quality of life (QoL) and patient satisfaction with an innovative flat-knit compression garment for the daytime treatment of lymphoedema patients in daily routine.

**Method:** In a prospective multicentre observational study, patients with leg or arm lymphoedema (stage I-II, International Society of Lymphology (ISL) standards, 2016) received a made-to-measure flat-knit compression class 2 JOBST Confidence (BSN-JOBST GmbH, Germany) thigh-high stocking or arm sleeve. Primary endpoint was the oedema status as determined by the mean sum of the circumferences at the beginning and the end of the wearing period. Secondary endpoints included QoL-related parameters and patient satisfaction with product features assessed through questionnaires. The observation period lasted three weeks.

**Results:** A total of 97 patients (87 females, 10 males), of which 65 had leg lymphoedema and 32 had arm lymphoedema, received the study device. The oedema status was effectively maintained

(slight reduction in mean sum of circumferences by  $-3.1 \pm 7.3$  cm;  $p=0.0001$ ). For QoL-related parameters, the patients reported fewer limitations in work, leisure and psychological wellbeing after wearing the stocking or arm sleeve (all  $p$ -values  $<0.0001$ ). They also experienced less limitations in function and movement, feeling of tension and heaviness, and fewer difficulties wearing clothes, shoes, jewellery or watches at study end (all  $p$ -values  $<0.0001$ ). In terms of pleasant feeling on the skin, moisture management, softness of material, range of motion, overall wearing comfort and heat build-up under the garment, patients were more satisfied with the tested compression garment than with previously worn compression garments (all  $p$ -values  $<0.001$ ).

**Conclusion:** In this study, the tested innovative compression product increased patient satisfaction with the improved product features while the lymphoedema status was successfully maintained.

**Declaration of interest:** The research and publication of this article was supported by BSN medical GmbH, Germany.

compression garment • flat-knit compression • lymphoedema • oedema management • quality of life • wound • wound care • wound dressing • wound healing

Compression therapy is considered the most important part of lymphoedema management.<sup>1</sup> However, treatment adherence is crucial for ensuring successful therapy outcomes.<sup>2</sup> Adherence is mainly affected by compression tolerability: poor choice of compression garment and its material can cause adverse effects, such as pain, discomfort, tightness, heat build-up under the garment, or skin irritation.<sup>3,4</sup> Such effects were shown to be one of the main reasons for non-adherence.<sup>3</sup> A survey among patients with lymphoedema revealed that 24% never wore their compression stockings.<sup>5</sup> Therefore, new technologies are needed to improve product features which are crucial for good therapy adherence.

To develop an innovative flat-knit compression garment which specifically addresses the needs of patients with lymphoedema, international market research was conducted on behalf of BSN medical GmbH, Germany, in Germany, France, the US and

China (data unpublished).<sup>6,7</sup> This research confirmed the results of previously published data.<sup>3,4</sup> Compression garments were found to cause discomfort, restrict mobility, and be hot and sweaty to wear. The market research found that, overall, the wearing of compression garments restricted the daily life of patients and thus resulted in poor adherence (data unpublished).<sup>6,7</sup>

During product development, the patients' main complaints and needs were carefully considered. To identify different body shapes, three-dimensional scanning was used, and special knitting techniques were applied to better mimic the anatomical shape of patients with lymphoedema. The manufacture of flat-knit and round-knit garments is based on the premise that the limb, at the point of measurement, is, in essence, a perfect circle. Clearly, extremities are not exactly circular. Therefore, a unique, patented Contour Fit technology (BSN-JOBST GmbH, Germany) was used, allowing stitches to be added or reduced in four positions, instead of one position, as is common in traditional flat-knit garments. The improved fit and the specific material properties of the garment increase wearing comfort and support a better freedom of movement. The combination of a two-layer knitting structure and functional yarns enable moisture management and thermal wearing comfort. The hydrophobic inner layer pushes moisture onto the

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outer surface of the garment, while the hydrophilic outer layer pulls any moisture away from the skin. This helps to keep the skin dry and to reduce heat build-up.

Both the clinical effectiveness of the compression garment and treatment adherence are important for achieving optimal therapy outcomes.<sup>8</sup> Improved

**Table 1. Overview of inclusion and exclusion criteria**

Inclusion	Exclusion
<ul style="list-style-type: none"> <li>Signed informed consent form</li> <li>Male, female or non-binary patients aged between 18–70 years with full legal competence</li> <li>Mentally and physically able to participate in the study</li> <li>Capable of understanding the subject information and providing conscious informed consent</li> <li>Capable and willing to follow protocol requirements</li> <li>All female or non-binary patients of childbearing age must agree to use a reliable method of contraception</li> <li>Mild-to-moderate lymphoedema of the lower and/or upper extremities (International Society of Lymphology (ISL) stage I or II)</li> <li>Indication and possibility of treatment with a flat-knitted compression garment during the day</li> <li>Must be familiar with wearing compression garments</li> <li>Indicated for complete decongestive therapy phase II (maintenance phase)</li> <li>Willingness to wear the study product at least five days per week for at least six hours per day</li> </ul>	<ul style="list-style-type: none"> <li>Pregnancy or lactation</li> <li>Alcohol and/or drug misuse</li> <li>Patients who need a different compression class (higher or lower than compression class 2)</li> <li>Pronounced skin folds or shape distortions</li> <li>cG (maximum thigh circumference) &gt;90cm for thigh-high compression stocking</li> <li>Indicated for complete decongestive therapy phase I</li> <li>Known allergy or intolerance to ≥1 components of the product</li> <li>Advanced arterial insufficiency including ischaemia</li> <li>Uncontrolled congestive heart failure</li> <li>Untreated septic phlebitis</li> <li>Phlegmasia cerulea dolens</li> <li>Immobility (confined to bed)</li> <li>Conditions in which increased venous and lymphatic return is not desired</li> <li>Weeping dermatosis</li> <li>Cutaneous infections</li> <li>Severely compromised skin sensibility and impaired sensitivity of the limb</li> <li>Advanced peripheral neuropathy</li> <li>Rheumatoid arthritis</li> <li>Complex regional pain syndrome (CRPS, Morbus Sudeck)</li> <li>Malignant lymphoedema</li> <li>Gangrene</li> <li>Open wounds in the test area</li> <li>Diuretics, except low doses for treatment of hypertension (≤12.5mg hydrochlorothiazide)</li> <li>Nephrotic syndrome</li> <li>Staff of sponsors or manufacturer</li> </ul>

**Table 2. Treatment protocol**

Study visit	Timing	Location	Purpose
Visit 1: screening visit	28 to 14 days before baseline visit	Practice of the principal investigator	<ul style="list-style-type: none"> <li>Obtaining the declaration of informed consent</li> <li>Collection of information on current lymphoedema treatment</li> <li>Completion of patient questionnaire on quality of life (QoL)-related parameters and satisfaction with their previous garment</li> <li>Issuance of order sheets for the study device, prescribed to be either used as a standalone compression garment or in combination with additional compression garments (e.g., bermuda, glove or toe caps) if necessary</li> </ul>
Visit 2: ordering visit	14 to 5 days before baseline visit	Sanitary supply store	<ul style="list-style-type: none"> <li>Ordering of the study device</li> </ul>
Visit 3: baseline visit	Day 0		<ul style="list-style-type: none"> <li>Issuance of the study device</li> <li>Lymphoedema assessment</li> <li>Circumference measurements</li> <li>Evaluation of product fit</li> </ul>
Visit 4: control visit	7 to 11 days after baseline visit		<ul style="list-style-type: none"> <li>Documentation of wearing habits</li> <li>Lymphoedema assessment</li> <li>Circumference measurements</li> </ul>
Visit 5: control visit	14 to 18 days after baseline visit		<ul style="list-style-type: none"> <li>Evaluation of performance parameters of the study device (including product fit and oedema management within the last 7 days)</li> </ul>
Visit 6: final visit (end of wearing period)	21 to 25 days after baseline visit	Practice of the principal investigator	<ul style="list-style-type: none"> <li>Documentation of wearing habits</li> <li>Lymphoedema assessment</li> <li>Circumference measurements</li> <li>Evaluation of performance parameters of the study device (including product fit and oedema management within the last 7 days)</li> <li>Completion of patient questionnaire on QoL-related parameters and satisfaction with the study device</li> </ul>

product characteristics with a focus on comfort, fit, mobility, heat and moisture management can lead to better adherence and therapy outcomes, as shown by previous case reports.<sup>5,9</sup>

### Objectives

The aim of this study was to evaluate clinical performance, parameters related to quality of life (QoL) and patient satisfaction with innovative, made-to-measure, flat-knit compression garments for the daytime treatment of patients with leg or arm lymphoedema in their daily routine.

### Methods

This prospective, multicentre observational study was conducted at four sites in Germany from August 2021 to December 2022. Patients with lymphoedema of the arm(s) or leg(s) and who were experienced in wearing compression garments were recruited for the study.

### Ethical approval and patient consent

The study complied with the Declaration of Helsinki and the International Organization for Standardisation (ISO) 14155. The study was approved by the Ethics Committee of Ärztekammer Sachsen-Anhalt, Germany, with the ethics approval reference 36/21, on 14 July 2021. Written informed consent was obtained from all the participants, including for the publication of photographs. The study was fully conducted under General Data Protection Regulation.

### Inclusion and exclusion criteria

Eligibility criteria are shown in Table 1.

### Treatment protocol

The observational period covered three weeks (wearing time) and six study visits. The timing and purpose of each study visit is shown in Table 2.

### Study device

The study device was a made-to-measure flat-knit compression class 2 JOBST Confidence thigh-high stocking or arm sleeve (BSN-JOBST GmbH, Germany) (Fig 1).

### Primary endpoint

The clinical performance of the device was evaluated by comparing the lymphoedema status at the beginning and end of the wearing period of the tested compression product. This was determined by the mean sum of circumference measurements at selected points (taken manually using a measuring tape).

### Secondary endpoints

Secondary endpoints were evaluated via patient questionnaires and included QoL-related parameters, such as limitations in work, leisure and psychological wellbeing due to the lymphoedema, before and after wearing the tested compression product. Further secondary endpoints were parameters related to patient satisfaction, such as wearing comfort, freedom of movement, moisture management and heat build-up. A comparison of these parameters was made between the previously worn compression garments and the tested compression product. Questionnaires were completed before wearing the tested compression product and again at the end of the study.

### Statistical analysis

#### Sample size

A total of 110 patients were considered for enrolment in the study. The expected drop-out rate was 20% (22/110).

#### Statistical methods

Mean±standard deviation (SD), percentiles, and minimum and maximum values were displayed for the primary endpoint, and frequencies of responses were shown as percentages for the secondary endpoints. Descriptive statistics were performed for baseline data, treatments, as well as primary and secondary endpoints. A t-test was used to assess the primary endpoint as the assumption of a normal distribution could not be rejected. For the secondary endpoints, a normal distribution could not be assumed, thus a Wilcoxon signed-rank test was used. Results were considered statistically significant when the p-value was <0.05.

The following data sets were evaluated:

- For primary endpoint analysis: all participants who wore the tested compression product for at least one week and attended at least one of the follow-up visits.
- For the secondary endpoint analyses: all participants who wore the tested compression product for at least one week and attended the final visit.

**Fig 1.** Patients wearing JOBST Confidence (BSN-JOBST GmbH, Germany) thigh-high stocking (a) and arm sleeve (b)



**Results**

A total of 99 patients were screened, 98 were included in the study and 97 received the study device (one patient was lost to follow-up after visit 1, before receiving the study device). The study was completed by 88 patients (90.7%).

**Study population**

The study population of 97 patients included 87 (89.7%) women and 10 (10.3%) men. Of these, 65 (67%) patients had leg lymphoedema and 32 (33%) patients had arm lymphoedema (stage I-II, International Society of Lymphology (ISL) standards<sup>10</sup>), and 21 (21.6%) patients were diagnosed with primary lymphoedema and 77 (79.4%) were diagnosed with secondary lymphoedema; one patient had both primary and secondary lymphoedema. The average patient had

2.7 concomitant diseases. The most frequent concomitant diseases were: hypertension (44 patients), hypothyroidism (29 patients), and breast cancer (23 patients; either ongoing or condition after). The mean age was 54.8±9.9 years (minimum: 18 years; maximum: 70 years). The mean body mass index was 30.2±6.4kg/m<sup>2</sup>. All 97 patients had previously worn flat-knitted compression garments.

**Primary endpoint**

In all, 92 patients were eligible for the primary endpoint analysis.

**Circumference measurements**

The analysis showed a slight reduction of -3.1±7.3cm in the mean sum of the circumferences at the end of the wearing period (p<0.0001) (Table 3).

**Secondary endpoints**

A total of 85 patients were eligible for the secondary endpoint analysis.

**Evaluation of QoL-related parameters**

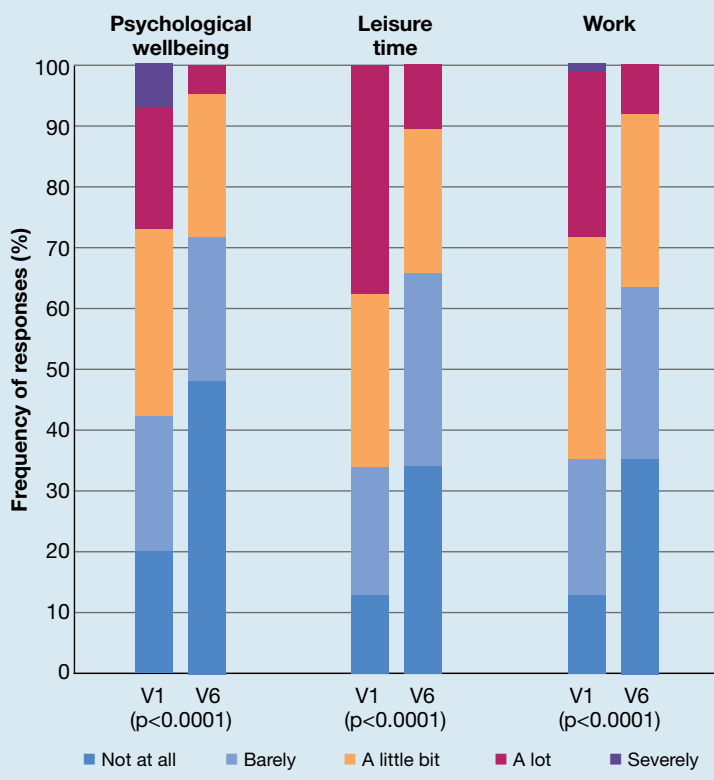
Questionnaires were used to assess the impact of the oedema on psychological wellbeing, leisure time and work. The patients evaluated these parameters for the previously worn product at visit 1 and for the tested compression product at visit 6 (Fig 2). Significantly more patients reported no or almost no restrictions in all rated categories when wearing the previously worn product compared with their previously worn product (all p-values <0.0001). No study participant reported severe restrictions when wearing the tested compression product.

Patients were also asked to assess the following categories with regard to their affected extremity: limitation in function and movement; feeling of tension; feeling of heaviness; and difficulty wearing clothes, shoes, jewellery or watches (Fig 3). In these categories, patients perceived significantly fewer limitations due to their lymphoedema at the end of the study (all p-values <0.0001). Of note, no patient reported a strong limitation in function and movement, or very strong feelings of tension and heaviness at visit 6.

**Evaluation of product features**

The patients evaluated different product features, such as: general wearing comfort; range of motion; fit; softness of the material; moisture management; pleasant feeling on the skin; and heat build-up under the garment (Figs 4 and 5). All product features were

**Fig 2.** Patients' evaluation of restrictions to psychological wellbeing, leisure time, and work due to their lymphoedema for the previously worn product at visit 1 (screening, V1) and the tested compression product at visit 6 (end of wearing period, V6)

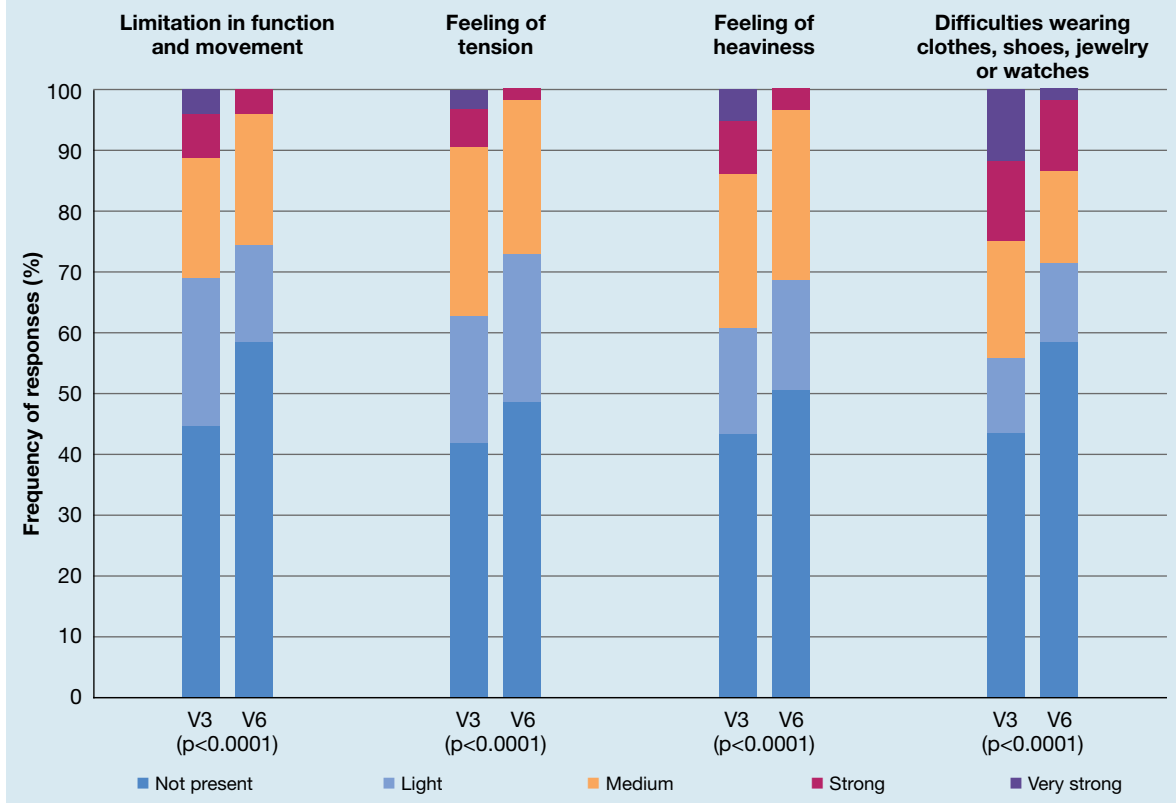


**Table 3. Comparison of the mean sum of circumferences between the baseline visit (V3) and end of the wearing period (V6)**

Variable	n	Mean	SD	Min	Q1	Median	Q3	Max	p-value
Mean sum of circumferences (V6 minus V3)	92	-3.1	7.3	-2.1	-7.5	-2.6	1.8	14	0.0001

Max—maximum; Min—minimum; Q—quarter; SD—standard deviation

**Fig 3.** Patients' evaluation of how oedema limited their function and movement, the feeling of tension, the feeling of heaviness, and difficulties wearing clothes, shoes, jewellery, or watches at visit 3 (baseline, V3) and visit 6 (end of wearing period, V6)



rated better for the tested compression product than for the previously worn product. Statistical significance ( $p < 0.001$ ) was reached for all features, except for product fit ( $p = 0.2083$ ).

Furthermore, patients had slightly fewer difficulties putting on and taking off the compression product, and needed significantly less help compared with their previously used products (help with putting on the product V6–V1: mean  $-0.2 \pm 0.5$ ;  $p = 0.0156$ ). Finally, when patients were asked whether they would recommend the tested compression product, most patients said that it is 'very likely' (56.5%) or 'rather likely' (16.5%) ( $p < 0.0001$ ) that they would recommend it to others (rating was based on a five-point scale ranging from 'very likely' to 'very unlikely').

## Discussion

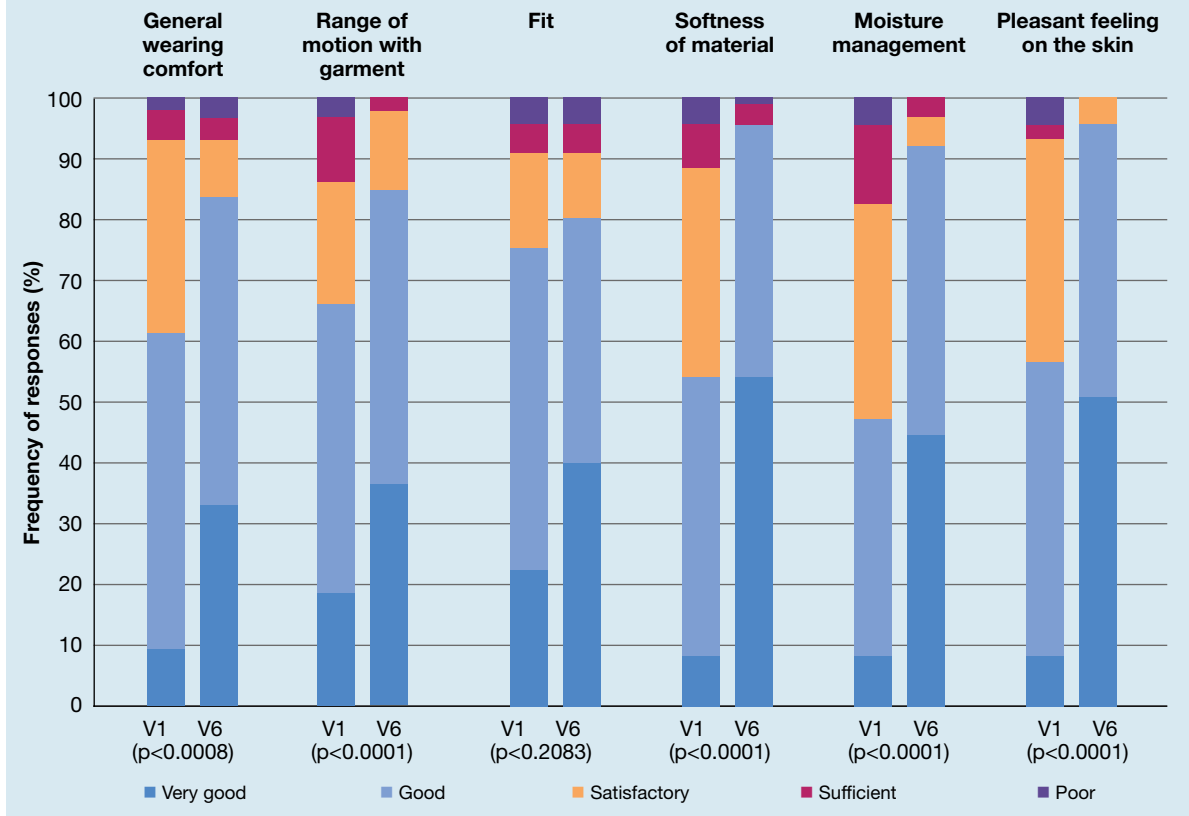
Wearing comfort, mobility, moisture management and thermal wearing comfort are critical aspects for adherence in wearing compression garments in patients with lymphoedema (data unpublished).<sup>6,7</sup> The tested compression product used in this study was shown to improve these factors, while the lymphoedema was successfully managed. Compared with their previously worn product, significantly more patients reported no or almost no restrictions when it came to work, leisure time and their psychological wellbeing due to their

lymphoedema when wearing the tested product.

Even though the importance and effectiveness of compression therapy is well known, there is little evidence on the impact of materials of which compression garments are made or of other product features (e.g., material surface and structure, fit/form, ability to manage heat, moisture etc.). In this study, most patients agreed that the tested compression product produced a pleasant feeling on the skin and confirmed the softness of the material. The tested compression product was also evaluated to be more comfortable and to provide a better range of motion compared with previously worn products. The improved product features resulted in increased comfort, while still effectively maintaining oedema status.

The patients reported improved QoL-related parameters when wearing the tested compression product. However, the impact of such features on treatment adherence and QoL in general needs further investigation. At present, there is no consensus on the most appropriate definition and measurement of treatment adherence.<sup>11</sup> Both the number of hours per day and the number of days per week that the compression garment is worn are important considerations.<sup>11</sup> However, the lack of a standardised approach to measuring treatment adherence makes it difficult to compare different study results.<sup>11,12</sup>

**Fig 4.** Patients' evaluation of product features of the previously worn product at visit 1 (screening, V1) and of the tested compression product at visit 6 (end of wearing period, V6)



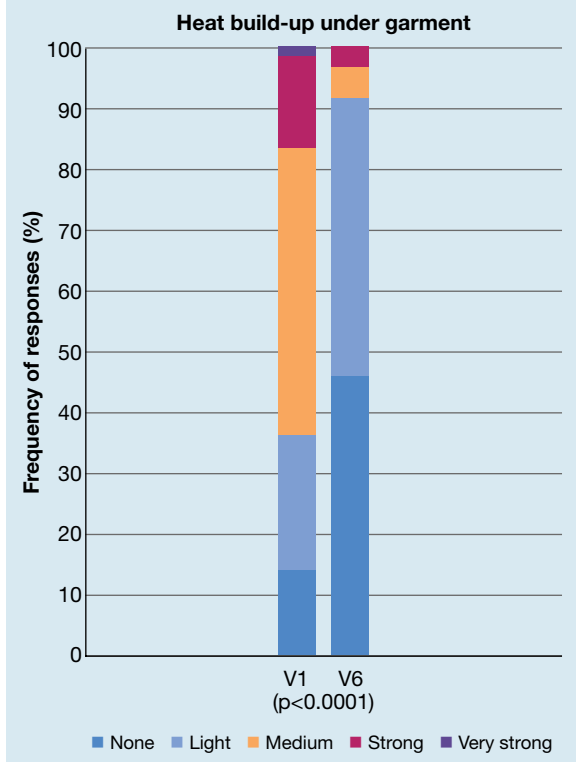
Treatment adherence to the tested compression product was defined, in this present study, as patients wearing the product for at least five days per week and at least six hours per day, and was investigated as an exploratory endpoint of the study (data not shown). The mean adherence with the tested compression product ranged from 77.2±19.2% to 84.9±16.7% depending on the imputation method for missing values. There is currently limited information from scientific literature about the treatment adherence with compression therapy.<sup>13</sup> A study with a large cohort of 3144 patients with chronic venous disease (CVD) revealed very low compliance to compression, with only 21% of patients reported as using the stockings on a daily basis, 12% using them most days, and 4% using them less often. The remaining 63% did not use the stockings at all or had abandoned them after a trial period in the past.<sup>14</sup> In contrast, a summation analysis of compliance with compression hosiery for patients with CVD or post-thrombotic syndrome, including 37 randomised trials and 21 prospective studies, showed that, overall, there was good compliance with compression in 5371 of 8104 (66.2%) patients.<sup>4</sup> The same study also demonstrated that different factors, such as the applied pressure and study type, influenced compliance.<sup>4</sup> However, since there is no standardised approach for measuring treatment adherence, reported values for

patients with CVD range between 20–98% in real-world studies.<sup>15</sup> So far, data on adherence in patients with lymphoedema is limited to case studies.<sup>16</sup>

As mentioned above, the assessed QoL-related parameters were significantly better for the tested compression product compared with the previously worn product. QoL in patients with lymphoedema is affected by various factors, including the presence of pain, skin quality, psychological factors and reduced mobility, among others.<sup>17</sup> There is limited information about which of these factors has the strongest impact on QoL; however, skin problems such as dryness and itching are frequently reported.<sup>18</sup> Since no standardised questionnaire was used in this study to analyse QoL on a more detailed and comparable level, the significance of the results needs verification.

Therefore, future studies are needed to evaluate the impact of improved product features on both treatment adherence and QoL. Valid and reliable tools to measure patient-reported outcomes specific to lymphoedema are also needed to better evaluate treatment efficacy from a patient's perspective.<sup>19</sup> The Dutch International Compression Club Compression Questionnaire (ICC-CQ), for example, could be a suitable method to assess the effect of compression and its acceptance in patients with lymphoedema or CVD.<sup>20</sup> In addition to assessing the improvement of QoL during treatment, it

**Fig 5.** Patients' evaluation of heat build-up under the garment for the previously worn product at visit 1 (screening, V1) and for the tested compression product at visit 6 (end of wearing period, V6)



also considers comfort of the material, ease of application and removal, and assesses the skin under the compression material.<sup>20</sup>

### Limitations

Single-arm studies are generally limited due to the lack of a control group. A direct comparison of the tested compression product to another compression garment could have resulted in a more robust assessment of product features and QoL-related parameters.

Furthermore, different health professionals (HPs)

evaluated the same parameters at different timepoints, e.g., study visit 1 and visit 6 were performed at the principal investigator's sites by physicians, whereas the intermediate visits 2–5 were performed by the fitters at the sanitary supply store. The comparison of the data from the baseline visit 3 and final visit 6 might have been more calibrated if carried out by the same HP.

In addition, 21 patients changed the style of their compression garment at study entry. Although this was not planned, the physicians deemed it necessary. Patients who had previously worn a knee-high compression garment switched to the thigh-high tested compression product. This may have impacted several parameters. A subgroup analysis showed, for example, that reduction in leg circumference was more pronounced in those who previously wore knee-high stockings. This was probably due to additional decongestion in the thigh region. The analysis also revealed that the majority of critical or negative ratings for the study device seemed to accumulate within the subgroup of patients who were not previously familiar with wearing thigh-high compression garments. This is in line with additional subgroup analysis results, which revealed that patients with lymphoedema of the upper extremity generally evaluated the study device more positively. Hence, some study results might have been weakened by mixing the two groups.

### Conclusion

This study demonstrated that the tested compression product, an innovative flat-knit garment with improved product features, effectively managed the oedema in patients with lymphoedema. The device improved wearing comfort, freedom of movement, moisture management and thermal wearing comfort, and decreased oedema-related restrictions to work, leisure time and wellbeing. Further studies are required to assess the impact of improved product features on treatment adherence. **JWC**

### Acknowledgements

The author would like to thank the patients who participated in the study, the onsite study coordinators, and BSN medical GmbH, Germany, for providing compression stockings and arm sleeves.

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**Reflective questions**

- Do compression garments with such improved product features also improve treatment adherence?
- To what extent do improved product features impact the quality of life of patients with lymphoedema?
- What is the best way to measure therapy outcomes in patients with lymphoedema?

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# NOT ALL ARMOR IS MADE OF STEEL



DEFY GRAVITY



## **JOBST® FARROWWRAP®**

A reliable choice for lymphedema management

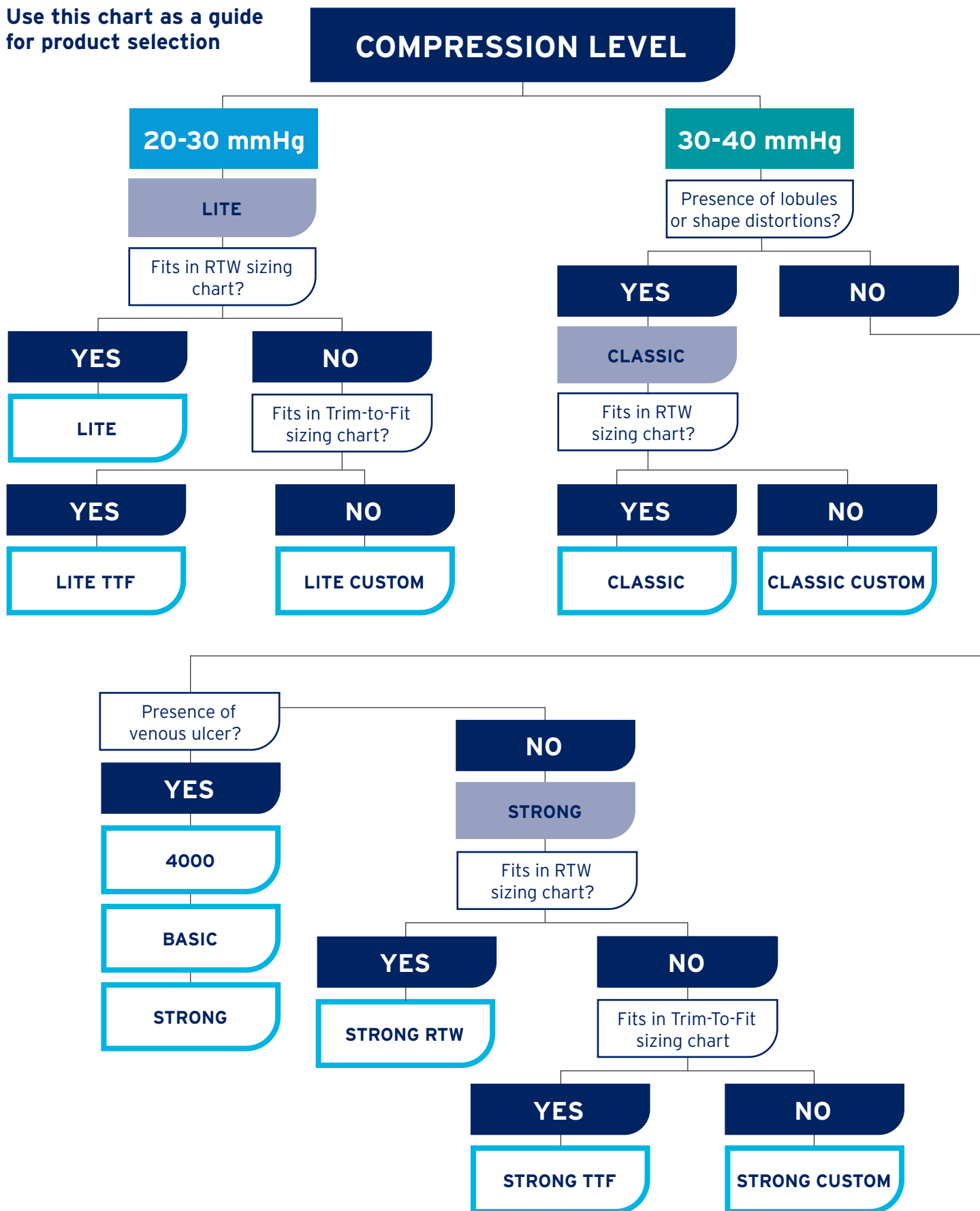
Give your patients the choice and variety needed to manage mild to severe lymphedema.

JOBST® FarrowWrap® is a patented, elastic, short-stretch wrap that gives the benefits of bandaging without the hassle. It's the perfect option for patients who have difficulty donning traditional compression stockings. It's designed to provide the same strong support as multilayer bandaging, but in a simplified, intuitive design which easily adapts to fluctuating edema levels.

Available in a variety of styles, fabrics, sizes and compression classes, JOBST® FarrowWrap® garments are made with durable materials to help decongest, maintain and prevent limb swelling during the day or night.

# Select the right JOBST® FarrowWrap®

Use this chart as a guide for product selection



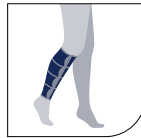
# A FarrowWrap® style to suit every need

## JOBST® FarrowWrap® STRONG (30-40 mmHg\*)

Premium fabric with strong compression and a soft, inner layer suitable for patients with good limb shape. Recommended for patients with moderate to severe edema.



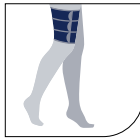
**Footpiece<sup>1,2,3</sup>**  
Approved HCPCS Codes  
**A6587 (LTA)**



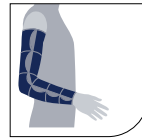
**Legpiece<sup>1,2,3</sup>**  
Approved HCPCS Codes  
**A6583 (LTA)**  
**A6545 (Surgical)**



**Kneepiece<sup>1</sup>**  
Approved HCPCS Codes  
**A6584 (LTA)**



**Thighpiece<sup>1,2,4</sup>**  
Approved HCPCS Codes  
**A6585 + A6584**



**Armpiece (Custom)**  
Approved HCPCS Codes  
**A6588 (LTA)**

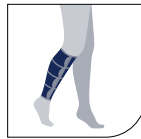
Colors **Tan**

## JOBST® FarrowWrap® CLASSIC (30-40 mmHg\*)

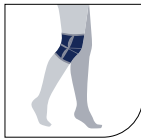
Made from more rigid material than JOBST® FarrowWrap® STRONG. Ideal for those with large lobules, skin folds or shape distortions.



**Footpiece<sup>1,2</sup>**  
Approved HCPCS Codes  
**A6587 (LTA)**



**Legpiece<sup>1,2</sup>**  
Approved HCPCS Codes  
**A6583 (LTA)**  
**A6545 (Surgical)**



**Kneepiece<sup>1,5</sup>**  
Approved HCPCS Codes  
**A6584 (LTA)**



**Thighpiece<sup>1,2,4</sup>**  
Approved HCPCS Codes  
**A6585 + A6584**



**Armpiece<sup>2</sup> (Custom)**  
Approved HCPCS Codes  
**A6588 (LTA)**

Colors **Tan**

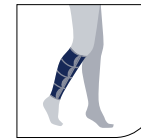
Improved VELCRO® with rounded corners. Landing strip at each strap.

## JOBST® FarrowWrap® BASIC (30-40 mmHg\*)

A value fabric with quality compression. The double-sided VELCRO® enables the band length to be trimmed as the limb reduces.



**Footpiece<sup>1</sup>**  
Approved HCPCS Codes  
**A6587 (LTA)**

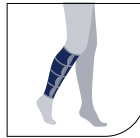


**Legpiece<sup>1</sup> (Includes FarrowHybrid Sock)**  
Approved HCPCS Codes  
**A6583 + A6594 (LTA)**  
**A6545 (Surgical)**

Colors **Tan**

## JOBST® FarrowWrap® 4000 (30-40 mmHg\*)

JOBST® FarrowWrap® 4000 is ideal for patients with moderate to severe venous and lymphatic conditions with or without a venous leg ulcer. The inner sleeve and 4-band juxtaposing design make for easy application. Anatomically contoured to help prevent gapping.



**Legpiece<sup>1</sup> (Includes FarrowHybrid Sock)**  
Approved HCPCS Codes  
**A6583 + A6594 (LTA)**  
**A6545 (Surgical)**

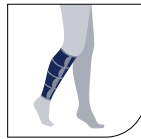
Colors **Tan** **Black**

## JOBST® FarrowWrap® LITE (20-30 mmHg\*)

A double-laminated, durable and breathable fabric especially suitable for home care use/self-management.



**Footpiece<sup>1,2,3</sup>**  
Approved HCPCS Codes  
**A6587 (LTA)**



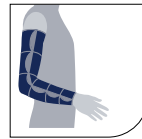
**Legpiece<sup>1,2,3</sup>**  
Approved HCPCS Codes  
**A6584 (LTA)**  
**A6545 (Surgical)**



**Kneepiece<sup>1,5</sup>**  
Approved HCPCS Codes  
**A6584 (LTA)**



**Thighpiece<sup>1,2,4</sup>**  
Approved HCPCS Codes  
**A6585 + A6584**



**Armpiece<sup>1,2,3</sup>**  
Approved HCPCS Codes  
**A6588 (LTA)**

Colors **Tan** **Black (only available for armpiece)**

### Hand Gauntlet\*\*

The JOBST® FarrowWrap® Hand Gauntlet manages swelling in the hand and can be used on either the left or right hand. Includes removable 4 mm and 8 mm hook and loop fasteners.

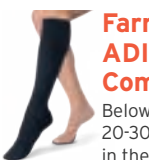
Approved HCPCS Codes  
**A6582 (LTA)**



### Toe Cap\*\* (15-20 mmHg\*, 20-30 mmHg\*)

Trimmable Ready-To-Wear toe cap for managing swelling in the forefoot and toes. Can be used on either foot, and is available in black and tan.

Approved HCPCS Codes  
**A6572 (LTA)**



### FarrowHybrid ADI Foot Compression Sock

Below knee high liner with 20-30 mmHg of compression in the foot and ankle area. Included with BASIC and 4000 Legpiece.

Approved HCPCS Codes  
**A6594 (LTA)**



### Easy Donning

Easy-to-attach VELCRO® brand tabs support easy donning and doffing.



### Short-Stretch Technology

Short-Stretch Technology provides low-resting and high-working pressures to enhance lymphatic and venous return.



### Adjustable

VELCRO® brand hook & loop system allows patients to respond better to fluctuating edema by simply tightening or loosening the wrap.



### 50% Band Overlap

Optimal width of bands - combined with 50% overlap of bands from bottom to top - provide ideal compression.



### Liner Options

- Standard Liner
- TG Soft Liner
- FarrowHybrid Liner



### Additional Accessories

- Garmet Grip
- VELCRO® Pack
- Short-Strech Wrap Extra Band

\*The average compression for a medium sized ankle.

\*\*Hand Gauntlet and trimmable RTW Toe Cap for managing mild to moderate edema. 1. RTW (Ready-To-Wear) 2. CM (Custom Made) 3. TTF (Trim-To-Fit) 4. Thighpiece must be worn with Kneepiece 5. STRONG kneepiece can be combined with CLASSIC garment

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# SIZING CHARTS

## Lower Extremity

### Ready-to-wear

	XSmall	Small	Medium	Large	XLarge
<b>Thighpiece (LITE, STRONG, CLASSIC)</b>					
<b>G</b> Groin	60-70 cm	67-75 cm	70-80 cm	75-90 cm	85-100 cm
<b>E</b> Above Knee	47-52 cm	53-59 cm	60-66 cm	67-73 cm	74-80 cm
<b>E-G</b> Short	16-20 cm				
<b>E-G</b> Regular	21-26 cm				
<b>E-G</b> Tall	27-31 cm				

### Legpiece (LITE, STRONG, CLASSIC, BASIC)

<b>C</b> Calf	36-43 cm	42-50 cm	48-58 cm	53-63 cm	58-68 cm
<b>B</b> Ankle	21-25 cm	25-30 cm	30-36 cm	36-42 cm	42-50 cm
<b>A-D</b> Regular	33-37 cm	35-39 cm	37-41 cm	39-43 cm	39-43 cm
<b>A-D</b> Tall	38-41 cm	40-43 cm	42-45 cm	44-47 cm	44-47 cm

### Footpiece (LITE, STRONG, CLASSIC, BASIC)

<b>A</b> Midfoot	22-24 cm	25-27 cm	28-30 cm	31-34 cm	35-40 cm
<b>X</b> Regular	16-17 cm	17-18 cm	19-20 cm	20-21 cm	22-23 cm
<b>X</b> Tall	18-19 cm	19-20 cm	21-22 cm	22-23 cm	24-25 cm

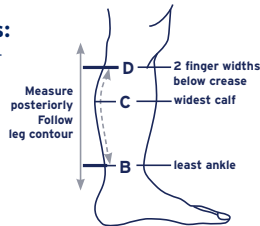
### FarrowWrap® 4000 Legpiece

<b>C</b> Calf	25-38 cm	32-48 cm	37-56 cm	43-67 cm	-
<b>B</b> Ankle	17-23 cm	19-28 cm	25-37 cm	29-43 cm	-
<b>B-D</b> Regular	30-33 cm				
<b>B-D</b> Tall	34-37 cm				

### FarrowWrap® 4000

#### 3 Easy Measuring Steps:

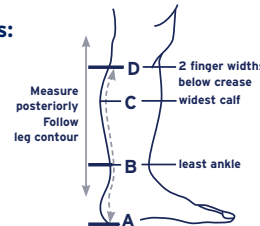
1. Length (B-D) - Ankle to 2 finger widths below crease of knee (follow contour of leg)
2. Circumference (C) - Calf (widest)
3. Circumference (B) - Ankle (smallest part)



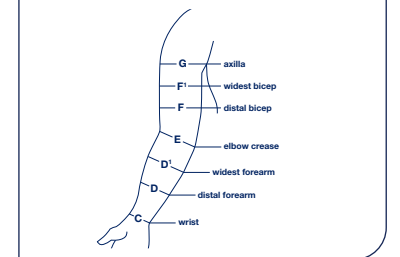
### FarrowWrap® LITE, STRONG, CLASSIC, BASIC

#### 3 Easy Measuring Steps:

1. Length (A-D) - Floor to 2 finger widths below crease of knee (follow contour of leg)
2. Circumference (C) - Calf (widest)
3. Circumference (B) - Ankle (smallest part)



### FarrowWrap® LITE, STRONG, CLASSIC



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Scan here to visit our **JOBST® USA** Compression Wraps & Bandages page:



Scan here to view our instructional donning videos:



## Upper Extremity

### Ready-to-wear

	Small	Medium	Large
<b>Armpiece</b>			
Wrist	14-18 cm	16-21 cm	19-25 cm
Elbow	20-27 cm	25-34 cm	30-40 cm
Axilla	22-31 cm	29-39 cm	32-45 cm
Short	40-43 cm		
Regular	44-47 cm		
Long	48-51 cm		

NOTE: Measure length from the outside of the wrist to the axilla (G) with a slight bend in arm

## Upper Extremity

### Trim-to-fit

	Medium	XLarge
<b>Armpiece</b>		
<b>G</b> Axilla Circumference	25-44 cm	30-48 cm
<b>F</b> Widest Bicep Circumference	25-42 cm	25-45 cm
<b>E</b> Elbow Crease Circumference	20-38 cm	25-42 cm
<b>D</b> Widest Forearm Circumference	20-36 cm	20-40 cm
<b>G</b> Wrist Crease Circumference	15-31 cm	15-35 cm
<b>E-G</b> Elbow Crease to Axilla Length	15-23 cm	20-28 cm
<b>C-E</b> Wrist to Elbow Crease Length	20-25 cm	20-28 cm



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# Managing ulceration and lymphorrhoea in chronic oedema

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Janet Drake RN*

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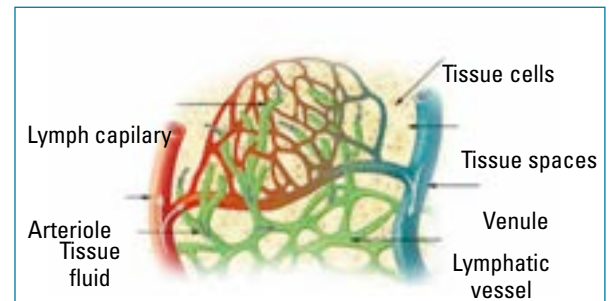
# Managing ulceration and lymphorrhoea in chronic oedema

**Marie Todd RN, MSc, Karen Lay-Flurrie BSc, RGN, Janet Drake RN**

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The rising prevalence of elderly and lifestyle-related chronic illness means chronic oedema and lymphoedema are likely to be encountered by many practitioners. They are caused and/or compounded by many increasingly prevalent chronic conditions, e.g. cancer, stroke, arthritis and chronic venous disease. Obesity and sedentary lifestyles also seriously impact on the development and progression of chronic oedema and lymphoedema. The sequelae of untreated chronic oedema include increased swelling, chronic inflammation, skin changes, superficial ulceration, and lymphorrhoea. The ultimate aim of management is to achieve self-care, either completely or supported by family or carers, and this requires tailoring the treatment to the individual patients' circumstances. Self-care also requires addressing the compounding lifestyle factors to prevent successful outcomes from being short term or unlikely (Todd, 2014). Nurses now have a greater range of tools to manage chronic oedema and lymphorrhoea, and by using a case-study methodology, this article will demonstrate the effectiveness of two of these tools, namely the Velcro wrap compression system (WCS) (JOBST® FarrowWrap®) and absorbent wound products (Cutimed® Sorbion® Sachet XL).



**Figure 1. Relationship between the arterial, venous, and lymphatic system in the interstitium showing all the interstitial fluid being absorbed by the initial lymphatics**

The interstitial circulatory system comprises arterioles, venules, and lymphatics. Oxygen and nutrients are delivered to the tissue cells via the arterial system and the waste products are removed by the venous system. The initial lymphatics absorb the tissue fluid and once filtered through the nodes, this fluid is returned to the venous system either at the right or left subclavian veins. It was initially understood that 90% of the tissue fluid entered the veins, leaving the lymphatics to mop up the remaining 10%, but it is now known that all the fluid is absorbed by the lymphatics (Mortimer and Rockson, 2014).

The three main functions of the lymphatics are:

- ◆ Fluid homeostasis by returning interstitial fluid to the venous system
- ◆ Immunity homeostasis by fighting infection
- ◆ Fat homeostasis by absorbing fats from the gut and mobilising peripheral fat when required (Mortimer and Rockson, 2014).

Damage to the lymphatic system may result in the development of lymphoedema (Mortimer and Rockson, 2014). Lymphoedema is a form of chronic oedema where the main cause is the treatment of cancer (surgery or radiotherapy), but other surgical procedures may necessitate the removal of lymphatic tissue, e.g. in the management of necrotising fasciitis. The area of swelling will depend on the area affected, e.g. axillary node dissection in breast cancer can result in corresponding arm swelling. In primary lymphoedema there is a congenital developmental fault in the lymphatics, which can be genetic (Connell et al 2013). This can result in the presence of swelling at birth

## ABSTRACT

This clinical review article on the combined use of JOBST FarrowWrap and Cutimed® Sorbion® Sachet XL uses a case study methodology to demonstrate how effective this approach is in managing superficial ulceration and/or lymphorrhoea in the presence of chronic oedema and lymphoedema. The blend of these symptoms causes significant physical and psychosocial issues for patients and is highly labour and resource intensive. However, there is often inadequate treatment choice leading to protracted input by nurses and delayed or failed healing. Only by combining an effective exudate/lymphorrhoea dressing choice with compression therapy, will there be a positive outcome and this will result in reducing nursing input, cost to the NHS, and enhance patient self-care.

## KEY WORDS

- ◆ lymphoedema ◆ chronic oedema ◆ ulceration ◆ lymphorrhoea ◆ compression wraps ◆ exudate

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**Table 1. ISL (2013) staging of lymphoedema**

	Presentation	Severity	Management
Stage 0 (latent sub-clinical stage)	No overt swelling but lymphatic pathways have been disrupted		
Stage 1 (early stage)	Mild pitting oedema that resolves with elevation	Mild – <20% increase in excess limb volume	Compression hosiery, exercise, simple- or self-lymphatic drainage, preventative skin care
Stage 2	Swelling does not resolve with elevation. Less evidence of pitting as fibrosis development occurs	Moderate – 20–40% increase in excess limb volume	Custom-made hosiery/ compression bandaging, exercise, self-/manual lymphatic drainage, skin care
Stage 3 (late stage)	Non-pitting with skin changes (papillomata, fibrosis, hyperkeratosis)	Severe – >40% increase in excess limb volume	Compression bandaging, skin care, exercise, manual lymphatic drainage

**Table 2. Skin changes in chronic oedema**

Hyperkeratosis	Thickening of the stratum corneum causing thick waxy scaly skin, which varies in colour from yellow to brown. Can be treated with regular washing and moisturising the skin, exfoliating products, or hydrocolloid dressings in severe cases
Papillomatosis	Intitial lymphatics protruding through the skin surface. Compression bandaging can reduce these
Fibrosis	Thickening and hardening of the subcutaneous tissues caused by the inflammatory process in venous and lymphatic disease. Compression bandaging can reduce this process in most cases
Exaggerated skin folds	Caused by overstretching of skin by oedema. Main areas are the ankles and toes but may also be present mid-calf and around the knee, or the wrist in arm swelling. Some compression hosiery can tourniquet here causing discomfort and breaks in the skin. There is also a higher risk of fungal infection in these areas. Regular washing and drying between the folds will reduce the risk of skin breakdown and fungal infection. Reducing the volume of oedema can reduce the skin folds

or it can be dormant for many years and develop later in life. The fluid output into the interstitium is normal but lymphatic uptake is reduced.

Chronic oedema results when there is no pathological fault in the lymphatics but other factors cause swelling, e.g. chronic venous disease, prolonged dependency of the limbs, obesity, and chronic organ failure (cardiac, renal). It usually affects the legs. In these cases the output into the interstitium exceeds the uptake capacity of the lymphatics.

Both lymphoedema and chronic oedema can have a devastating physical and psychosocial effect on both the patients and their families. The extra weight of the swollen limb(s) can affect gait, mobility, and cause pain in surrounding joints and muscles. There is often difficulty with clothing and footwear, and this causes body image and social issues. Many find it difficult to maintain their current employment or find alternatives and this can lead to, or exacerbate, sedentary lifestyles (Moffatt et al, 2003). Skin changes (Table 2) are more prevalent in chronic oedema (Todd et al, 2017), mainly in the lower legs but can also be present in the upper legs and on a pendulous apron in the morbidly obese. Patients relate skin changes with being dirty (Todd, 2013), and there is often superficial ulceration that requires resource-intensive input in terms of nursing time and wound management products. Unfortunately

this input is often prolonged over many months or years because of inadequate management strategies (poor wound care choice and lack of compression) and poor patient concordance.

Lymphorrhoea (lymph fluid exuding onto the surface of the skin) accompanies wound exudate in ulceration and results in wet clothing, footwear, and bedding. It can also be present in lymphoedema following minor trauma to the lymphoedematous area, especially in vulnerable skin of the elderly or palliative patients (Board and Anderson, 2013). In isolation, it appears as straw coloured watery fluid but in the presence of wound exudate, its colour and consistency will be dictated by the exudate. It is more common in the lower legs, especially if prolonged dependency is an issue, but other areas can be affected, e.g. in a lymphoedematous arm. If left unmanaged, lymphorrhoea can cause moisture-related skin damage (maceration), which can lead to more widespread ulceration, especially if there is chronic wound exudate present. Exudate from chronic wounds is known to be destructive to the wound bed because of a high concentration of proteases and diminished growth factors (Vowden, 2011).

In chronic oedema and lymphoedema there is a risk of cellulitis (Cooper, 2016) but this risk is increased if the integrity of the skin is compromised, e.g. ulceration and

**Table 3. Management of chronic oedema and lymphoedema**

	<b>Aim of approach</b>	<b>Strategies involved</b>
Lymphoedema self-care approach	If there is mild swelling and no skin changes. Aim is to prevent increase in swelling and development of skin changes	Compression garment and/or wrap compression system (WCS), skin care, exercise, lifestyle advice, and simple/self-lymphatic massage (SLD)
Lymphoedema intensive approach	When there is significant swelling, skin changes, or lymphorrhoea. Aim is to reduce swelling, reverse skin changes, and stop lymphorrhoea	Compression bandaging or WCS, skin care, exercise, lifestyle advice, manual lymphatic drainage (MLD). Carried out by lymphoedema specialist
Chronic oedema self-care approach	Mild to moderate swelling, no ulceration. Aim is to prevent increase in swelling and development of skin changes	Compression hosiery and/or WCS, skin care, exercise, and lifestyle advice
Chronic oedema intensive approach	Severe swelling with skin changes/ulceration. Aim is to heal the ulceration/reverse skin changes and reduce the swelling.	Compression bandaging or WCS, wound care products/skin care, exercise, lifestyle advice. Carried out by community nurses with possible advice and support from lymphoedema specialist

lymphorrhoea.

Management of chronic oedema and lymphoedema should ultimately lead to self-care (Todd, 2013a). While there are differences in these two conditions, there are some similarities in their management (Table 3).

Compression aids the impaired lymphatic and venous drainage by:

- ♦ Augmenting the calf muscle’s natural pumping activity
- ♦ Preventing venous backflow
- ♦ Reducing capillary filtration and increasing interstitial pressure which leads to greater absorption of fluid by lymphatics
- ♦ Stimulation of lymphatic contraction.
- ♦ Breaking down fibrosed tissue and enhancing the flow of nutrients to the skin, which improves healing (Partsch and Junger, 2006).

There are various ways that compression therapy can be delivered it but must be based on an holistic assessment and the patient’s individual circumstances. Guidance on which type of compression product to use is given in Table 3, but practitioners must note that there may be instances when an alternative approach is required, for example, compression hosiery is indicated but if there are strength or dexterity issues a WCS may be more appropriate. Similarly, if bandaging is indicated but access to specialist nurses is difficult the WCS is a viable alternative. Other indications for use are for those who are unable to bend or reach the lower legs because of, for example, back problems, obesity, and older age (Lawrance, 2008), or if the patient has fragile skin and applying compression stockings may cause damage. The WCS is made of inelastic fabric that wraps around the limb and is secured with Velcro straps (Williams, 2016). It is adjustable, allowing patients to manage fluctuating oedema themselves and subsequently giving them the power to control their self-care. Cost savings can be achieved with the WCS compared to the cost of bandaging materials, with subsequent reduced time involved for professionals and patients due to quicker and easier application of the device (Williams, 2016).

Most lymphoedema specialists favour an inelastic, short-stretch compression system (Partsch, 2007) and the WCS

provides this. Inelastic ‘intelligent bandaging systems’ applied at full stretch will form a rigid cast around the limb, delivering high working pressures creating the pulse effect during muscle contraction, while providing tolerable lower pressures during rest, making them more comfortable and improving compliance (Partsch et al, 2008). This makes short-stretch compression effective in the treatment of lymphoedema, chronic oedema, and chronic venous insufficiency.

### Management of lymphorrhoea

Lymphorrhoea presents some significant challenges for both patients and the health professionals. It is important to initiate treatment immediately to prevent further breakdown of the skin and increase the risk of cellulitis. Appropriate dressing selection should be non-adherent, absorbent, and prevent maceration of the skin (Wounds UK, 2012). Frequency of dressing change will be dictated by the volume of lymphorrhoea and initially this may be daily. However, compression must be included in the treatment strategy, otherwise the process will be protracted and probably unsuccessful, especially if there is also ulceration present. There is anecdotal evidence of patients receiving wound management care for many years without success because compression is not included, it is likely that this represents an immense cost to the NHS.

Cutimed Sorbion Sachet XL is a super-absorbent dressing suitable for almost all types of moderate to highly exudating wounds and lymphorrhoea. The dressing uses Hydration Response Technology; a fibre matrix with gel polymers encased in an outer sachet that is sealed ultrasonically, providing state-of-the-art exudate and lymphorrhoea management and wound-bed preparation, creating the ideal moist wound healing environment. It is also available in a range of shapes and sizes including: Cutimed Sorbion Sachet S (for moderate to high exudate levels), Cutimed Sorbion Sachet Extra (for very high levels) and Cutimed Sorbion Sachet Multi Star (a flexible shape for a multitude of body contours), and all are effective under compression. Used in combination with the JOBST FarrowWrap, can provide the ideal conditions for oedema

reduction, exudate and lymphorrhoea control, and wound healing. The super absorbency reduces the need for more frequent dressing and bandage changes, and limits maceration of the skin. This in turn cuts down on nurses visits, reducing overall costs and increasing patient freedom (Williams, 2016).

### Case studies

The Leg Ulcer Clinic situated in St Albans City Hospital, was established in 2006, primarily as an assessment and treatment service for patients with venous or mixed arterial venous ulceration and for those with chronic oedemas and non-cancer related lymphoedema. The service is only for West Hertfordshire and forms part of the wider leg ulcer service that covers East and North Hertfordshire. The clinic is staffed by two nurses – a Leg Ulcer Specialist Nurse and a Leg Ulcer Support Nurse who are trained in both leg ulcer and oedema management and run the clinic full time 5 days a week.

The following case studies are examples of the use of JOBST FarrowWrap and JOBST FarrowWrap Lite on 4 patients from our caseload and where clinically indicated, on the combined use of JOBST FarrowWrap and Cutimed Sorbion Sachet XL where lymphorrhoea/exudate management was needed.

#### Patient 1 Miss W

Miss W, 58 years old, has been on our leg ulcer caseload for a number of years with recurrent bilateral venous leg ulceration and cellulitis and lymphoedema since 2003. During episodes of healing she has been wearing class 2 made to measure below knee, open toe compression hosiery. However, due to the shape of her legs the hosiery tends to cut in below her knees and slips down which causes increased oedema below the knees. The hosiery has also not been effective in preventing recurrence of her ulceration. Due to blisters on her thighs she could not tolerate a thigh piece. It is hoped that once she has seen a dermatology specialist again we can discuss the option of using a thigh piece at a later date. Miss W is also obese (presenting BMI 41) and her large girth makes it difficult for her to bend to reach her toes to put her hosiery on. She was previously a full time carer for family members, a role which has now ceased, and as a result she had become less active and her level of

motivation to become more mobile had declined. Miss W had an excision of an acoustic neuroma several years ago and has more recently developed likely bullous pemphigoid and is awaiting further dermatology review after declining a biopsy last year to confirm diagnosis. She tends to develop blistering around her thighs and on occasion to the gaiter area of her lower legs and dorsum's of the feet.

Miss W has had ulceration to both gaiter areas for several months, which have taken some time to progress towards healing. Her most recent Doppler was recorded as right ABPI 0.83, left ABPI 0.92, with triphasic pulses.

As the wounds to Miss W's legs were making good progress we decided to use the opportunity to discuss possible alternatives to her current hosiery, which may make self-care easier for her. Miss W was open to discussion and used the opportunity to state that she wished to make positive changes to her lifestyle to facilitate some weight loss. She has begun a programme in which healthy reduced calorie meals are delivered and has also started to spend less time sitting in the chair and using the opportunity to be more active in her garden.

Miss W did not want to have to change the dressings to her legs everyday. With this in mind it was decided to try Flaminal® Hydro gel to facilitate debridement of the wounds under (the patient was previously treated with this and AQUACEL Ag Extra dressings) with a Cutimed Sorbion Sachet XL to absorb exudate as the volume of exudate tends to fluctuate depending on Miss W's level of activity. She also sits with the legs dependant during the day, despite advice to the contrary, and this was also one of the reasons for selecting JOBST FarrowWrap Classic as it was felt that an increased level of compression would help complete and maintain healing. Coupled with her ongoing plans to address her weight issues, to date she has lost 2 stone in weight, which may impact on the circumferences of her lower limbs, it was felt that the JOBST FarrowWrap Classic strapping could be adjusted to fit and that she would be able to do this herself.

On initial review Miss W reported that she had managed to change the JOBST FarrowWrap Classic system, which she had done once in the week. There had not been the slippage that she usually experienced with the compression hosiery. The dressings had also contained the exudate and there had been no leakage or odour through the system, which she was pleased about as she did not have to change the dressing



**Patient 1: Miss W left leg prior to application of JOBST FarrowWrap (A), Miss W right leg prior to application of JOBST FarrowWrap (B), Miss W JOBST FarrowWrap in situ (C), Miss W right and left leg following application of JOBST FarrowWrap (D)**

more than once. Miss W did not feel the JOBST FarrowWrap looked as nice as hosiery but could appreciate that the fit was improved. She is keen to try and maintain the positive changes she is making and with encouragement continues to wear the JOBST FarrowWrap and Cutimed Sorbion Sachet XL combination and persist with her weight loss meal plan and heightened level of activity.

**Patient 2 Mr J**

Mr J (65 years old) presented with bilateral lymphoedema secondary to his obesity – presenting BMI 50. He had grossly oedematous lower legs including the feet and toes. There was constant leakage of lymphorrhoea and he had large areas of excoriation of the skin. He had had multiple episodes of cellulitis as a result and had been unsuccessfully managed with both compression bandaging and hosiery. He had no medical history of note other than borderline type 2 diabetes mellitus, the monitoring of which is ongoing.

Mr J’s main problem is that his obesity does not allow him to sit comfortably with his legs elevated and he does not go to bed at night. He has also been unable to change compression hosiery easily. He is at present resistant to intervention to address his underlying weight issues.

Mr J has a small holding and cares for his animals without any help and he is reluctant to explore any means of assistance with this. His animals are very important to him often to the detriment of his own health. He was keen to manage his lymphoedema and to become independent with compression garments and to spend less time travelling backwards and forwards to have his legs dressed. He also found that the bandages were too bulky and often slipped down, once causing a deep iatrogenic wound to the back of his knee which was very painful for him.

On examination Mr J had no signs or symptoms of venous or arterial insufficiency. Pulses were uncompressible on Doppler ABPI/TBPI but were audible with handheld Doppler and triphasic. There was minimal oedema of the feet and toes and as Mr J could not reach his feet it was decided to use the leg piece only in the first instance. Mr J was unsure which system he would manage easiest and has found class 2 hosiery difficult to tolerate in the past, therefore it was decided to try a JOBST FarrowWrap Lite to the left leg as this was the less oedematous of the two and a JOBST

FarrowWrap Classic system to the right leg initially. In order to manage the exudate, AQUACEL® Ag Extra was applied to the areas of excoriation with Cutimed Sorbion Sachet XL to cover. The patient attended clinic weekly and although he was being treated with AQUACEL Ag Extra previously, this was not managing the volume of exudate and so the addition of Cutimed Sorbion Sachet XL was required.

Mr J initially had the dressings changed 2–3 times weekly. The left leg healed after 1 month of treatment and the areas of excoriation to the right leg considerably reduced. Mr J was able to adjust the JOBST FarrowWrap system although had not managed to change it independently but had found them more secure without the previous slippage he experienced and he was able to carry out his day to day activities more comfortably as he experienced much less pain and leakage and odour than before. It is hoped that in the longer term we will be able to support Mr J to address his weight issues and look at strategies to help him lose weight, which will facilitate his independence with managing the JOBST FarrowWraps.

**Patient 3 Mrs F**

Mrs F (76 years old) was referred to the service by her GP with a long-standing history of bilateral lower leg lymphoedema of many years’ duration. The lady has previously tried multiple different makes of hosiery but struggled with application and removal even with the assistance of her husband. This was compounded by her obesity and large girth with presenting BMI of 40.8. Mrs F has found weight loss difficult despite input from the dietetic service at several points over the last years. Of note, in her medical history, she has type 2 diabetes mellitus and chronic kidney disease. The GP also reported recurrent episodes of cellulitis.

On examination Mrs F had bilateral non pitting oedema below the knee with induration and papillomatosis. The skin was stretched, fragile and shiny. Stemmer’s signs negative. There were currently no wounds to either limb or varicose eczema which had apparently troubled her in the past. Toes and feet were well kept with no signs of fungal infection and web spaces between the toes were clean and dry. Pulses were uncompressible on Doppler ABPI/TBPI but were audible with a handheld Doppler and triphasic.

Initial limb circumferences were recorded as right ankle



**Patient 2: Mr J left leg prior to application of JOBST FarrowWrap (A), Mr J right leg prior to application of JOBST FarrowWrap (B), Mr J Cutimed Sorbion Sachet XL dressing in situ (C), Mr J JOBST FarrowWrap in situ (D)**

31cm; calf 47.5cm; left ankle 34cm; calf 47.5cm.

Mrs F was shown samples of the JOBST FarrowWrap and preferred the appearance of the JOBST FarrowWrap Lite. She also wore small, heeled, slip on shoes and wished to be able to continue to do this and therefore did not want to wear anything bulky over her feet and this was non-negotiable. Therefore, it was agreed that she would try the leg piece only.

We agreed initially to apply Actico short stretch bandaging for 2–3 weeks to improve the condition and shape of the limbs prior to fitting the JOBST FarrowWrap Lite. Once fitted, Mrs F's husband was able to help her with a daily skin care regime and removal and reapplication of the JOBST FarrowWrap Lite. He initially expressed some concern that he was applying them 'too tightly' although Mrs F found them comfortable, and there was no evidence of any marking to the legs. They continued to manage well with the JOBST FarrowWraps and reduction in limb circumferences and skin integrity were maintained. Mrs F expressed that she was happy with the JOBST FarrowWraps and was pleased that she could wear her usual footwear and they even managed to take a holiday and reported no problems whilst they were away.

Limb circumferences on completion of treatment: right ankle 30cm calf 44cm; left ankle 28cm; calf 44cm.

#### Patient 4 Mr T

Mr T is a current patient on our well leg caseload. He was referred to the service back in December 2012 with venous hypertension of both lower limbs and ulceration to the right medial malleolus. Being a younger patient, aged 53 at the time of initial presentation, Mr T was keen to self-care and be able to shower and was therefore treated with a Comfipression Hosiery Kit™ to give 40mmHg compression. Mr T managed very well with this and healed in January 2013. Mr T has a history of myocardial infarction 20 years ago and had an implantable cardioverter defibrillator fitted in 2010, although this has never been activated. He has also had multiple deep vein thromboses and a pulmonary embolism in 1997 for which he remains on warfarin.

Mr T was previously employed in the construction industry but had to retire early due to his ongoing health issues. As a result of this he subsequently became less active, which he attributes in part to his family being more protective and letting him undertake less tasks at home. He has struggled with weight issues and presented with a BMI of 39. He had been diligent with wearing hosiery but over the last year has found it more difficult due to back pain and increasing shortness of breath, and as a result of this stopped wearing his compression hosiery. He reported that the legs then became more oedematous quickly. He also found that his legs ached without wearing any form of compression. He enjoys looking after his grandchildren and is keen to play an active role in day-to-day family life as much as possible and was enthusiastic about finding an alternative to hosiery.

On examination there were multiple signs and symptoms associated with venous insufficiency including haemosiderin staining, ankle flare and atrophie blanche. Mr T also has prominent varicose veins. The skin to the legs was stretched, fragile and shiny but there were no wounds or eczema. Mr T



**Patient 3: Mrs F left leg prior to application of JOBST FarrowWrap (A), Mrs F right leg prior to application of JOBST FarrowWrap (B), Mrs F JOBST FarrowWrap in situ (C)**

reported that the legs became progressively more oedematous during the day. Doppler ABPI was undertaken and recorded as right ABPI 1.13 and left ABPI 1.11 with triphasic pulses.

Initial limb circumferences: right ankle 27cm; right calf 42cm; left ankle 28cm; left calf 40cm.

Following discussion, it was agreed to try the JOBST FarrowWrap Lite in the first instance as Mr T has some arterial risk factors and has only been tolerating class 2 hosiery. Mr T had no oedema of his feet and was keen to wear his usual trainers and it was agreed to try the leg piece only.

Mr T was shown how to apply the JOBST FarrowWrap Lite and was happy to try and manage to change it. On first review he reported some chaffing and there was some indentation to the skin. He reported that he did not find it as aesthetically pleasing as the hosiery, however he was appreciative of the fact that he could manage to change the JOBST FarrowWrap Lite whereas the hosiery he could not, even with the use of an applicator. He also felt better for wearing compression and is happy to persevere. We have discussed strategies such as not overstretching the JOBST FarrowWrap Lite when putting it on and adjusting it for comfort during the day. We will continue to monitor and may consider the use of JOBST FarrowWrap Classic at a later



**Patient 4: Mr T JOBST FarrowWrap in situ (A), Mr T following application of JOBST FarrowWrap (B)**

date if it is felt he requires an increased level of compression.

## Conclusions

The prevalence of chronic oedema and lymphoedema is increasing as the ageing population grows and lifestyle-choice-related chronic illness rises. Nurses need to be proactive in their management of these conditions and their probable sequelae, i.e., ulceration and lymphorrhoea. JOBST FarrowWrap used in combination with Cutimed Sorbion Sachet XL can reduce the time and cost of this management, and lead to greater compliance and self-care. **BJCN**

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