

# The CHROSS Checker: a tool kit to detect early skin changes associated with venous and lymphovenous disease

Janice Bianchi

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## CHROSS Checker

By recognising early changes,  
disease progression can be prevented or slowed...

...with a little bit of detective work.



Prevention

Early/medium  
intervention

Intensive management

# The CHROSS Checker: a tool kit to detect early skin changes associated with venous and lymphovenous disease

Janice Bianchi

In patients with venous and lymphovenous disease, skin changes to the lower limb(s) occur gradually, and become more serious over time if left untreated. The CHRONic Oedema Signs and Symptoms (CHROSS) Checker is a tool kit consisting of an assessment chart and key cards that have been developed to help clinicians easily identify the skin changes that occur as a result of underlying venous and lymphovenous disease, when carrying out holistic patient assessment. It also provides clear guidance on which compression products can be used to manage the disease type and severity of skin change. For clinicians unfamiliar with some or all of the signs and symptoms listed on the CHROSS Checker chart, the key cards contain further information in the form of a photograph, definition and cause of each sign and symptom listed. This article will describe the theory behind the development of the CHROSS Checker tools and explain how to use them in clinical practice.

## KEYWORDS:

Assessment ■ Skin changes ■ Venous disease ■ Chronic oedema  
Lymphovenous disease ■ Compression ■ CHROSS Checker

Patients with disease of the venous and/or lymphatic system undergo a number of skin changes on the lower limb(s) as a consequence of underlying disease processes (Timmons and Bianchi, 2008). These changes can easily be detected during routine cleaning and assessment of the patient's limb(s) and skin, and, once identified, can be appropriately managed to slow disease progression. If venous or lymphovenous disease is allowed to progress untreated, however, the patient will gradually develop more severe skin changes over time (Timmons and Bianchi, 2008). For example, symptoms such as varicose veins could eventually lead to leg ulceration and/or chronic oedema if the underlying disease process is not addressed.

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This article describes how venous and lymphovenous disease results in skin changes and how to use the CHRONic Oedema Signs and Symptoms (CHROSS)Checker (Figure 1). This tool kit has been designed to raise awareness of the signs and symptoms of venous and lymphovenous disease, and make skin changes easy to spot and assess in clinical practice. The kit also provides recommendations for the most appropriate compression hosiery to manage disease (according to the severity and type of signs/ symptoms) as part of an overall treatment plan to improve patient care and outcomes.

## THE VENOUS SYSTEM

Blood travels through the arteries away from the heart, carrying oxygen and nutrients to the tissues and organs of the body, and returns via the veins, carrying waste products and carbon dioxide.

Arteries have thick, elastic walls, as blood is ejected from the heart under pressure. The main arteries branch into smaller vessels, the arterioles, then into even smaller ones, the capillaries, that reach the tissues and organs. The walls of the capillaries are only one cell thick so that oxygen, glucose and other substances can pass from the blood into the interstitial fluid (the fluid that bathes all of the cells in the body), then into the tissues and organs.

The capillaries are where the arterial system of blood vessels end and join the vessels that make up the venous system. From the capillaries, blood flows into small veins that are known as venules, which in turn, join the large veins that return deoxygenated blood and waste back to the right side of the heart. The blood travelling in the veins is under less pressure than in the arteries, so these vessels have thinner walls. As a result, the veins are able to expand depending upon the volume and pressure of blood inside. For example, if there is a low volume of blood and therefore low pressure in the vein, the veins are flat, whereas if the volume and therefore pressure increases, the vein expands (Starr et al, 2008; Koeppen and Stanton, 2010).

The venous network is made up of three types of veins (Figure 2):

- ▶ Deep veins which lie within the muscles of the arms and legs and carry blood back to the heart
- ▶ Superficial veins, nearer the surface of the skin, which carry blood from the skin back to the deep veins
- ▶ Perforator veins that join the deep and superficial systems.

In the lower limbs, blood returning to the heart has to travel

Patient name

Date:



# The CHROSS checker

It is important to check for the signs and symptoms of venous and lymphovenous disease, which are listed in the chart below, as part of a full, holistic assessment.

1. The chart should be used as a prompt to check for skin and limb changes as part of holistic patient assessment.
2. The compression products recommended should be used as part of an overall management plan, which includes medical management of underlying disease(s), skin and wound care, and patient education.
3. Vascular status must be determined before applying compression. If in doubt, do not use and refer for specialist advice.
4. If no ticks are recorded, the limb is healthy and no action is needed, other than a good skin care regimen.
5. Intensive bandaging to reduce limb volume may be required before hosiery can be effectively used.
6. For more information on the signs/symptoms listed below, including photos and description, refer to the accompanying key cards.

	1	2	3	
	Tick the box below if the sign/symptom is reported by, or present on the limb of, the patient	Is oedema also present? Tick yes or no (in the colour band of the lowest tick in step 1)	Consider application of the compression below, depending on disease severity (mild, moderate or severe) as part of management	
Prevention	Tired, aching, heavy legs <input type="checkbox"/>	NO <input type="checkbox"/>	Activa® British Standard hosiery <sup>*</sup>	
	Spider veins <input type="checkbox"/>		Mild: Class 1 (14–17mmHg) <input type="checkbox"/>	
	Mild varicose veins <input type="checkbox"/>		or	
	Ankle flare <input type="checkbox"/>		Moderate: Class 2 (18–24mmHg) <input type="checkbox"/>	
	Mild hyperkeratosis <input type="checkbox"/>	YES <input type="checkbox"/>	ActiLymph® European class hosiery <sup>**</sup>	
	Moderate varicose veins <input type="checkbox"/>		Mild: Class 1 (18–21mmHg) <input type="checkbox"/>	
	Hyperpigmentation <input type="checkbox"/>		or	
	Venous dermatitis <input type="checkbox"/>		Moderate: Class 2 (23–32mmHg) <input type="checkbox"/>	
Early/medium intervention	Varicose eczema <input type="checkbox"/>	NO <input type="checkbox"/>	Activa® British Standard hosiery <sup>*</sup>	
	Atrophie blanche <input type="checkbox"/>		Moderate: Class 2 (18–24mmHg) <input type="checkbox"/>	
	Induration <input type="checkbox"/>		or	
	Severe varicose veins <input type="checkbox"/>		Severe: Class 3 (25–35mmHg) <input type="checkbox"/>	
	Moderate hyperkeratosis <input type="checkbox"/>	YES <input type="checkbox"/>	Activa® Leg Ulcer Hosiery Kit <input type="checkbox"/>	
	Healed ulcer* <input type="checkbox"/>		ActiLymph® European class hosiery <sup>**</sup>	
	Recurring ulcer/open ulcer** <input type="checkbox"/>		Moderate: Class 2 (23–32mmHg) <input type="checkbox"/>	
	Cellulitis*** <input type="checkbox"/>		or	
Intensive management	Lipodermatosclerosis (acute or chronic) <input type="checkbox"/>	NO <input type="checkbox"/>	Severe: Class 3 (25–35mmHg) <input type="checkbox"/>	
	Chronic oedema <input type="checkbox"/>		YES <input type="checkbox"/>	ActiLymph® European class hosiery <sup>**</sup>
	Lymphorrhoea (wet legs) <input type="checkbox"/>			Moderate: Class 2 (23–32mmHg) <input type="checkbox"/>
	Severe hyperkeratosis <input type="checkbox"/>	or		
	Skin folds <input type="checkbox"/>	Severe: Class 3 (34–46mmHg) <input type="checkbox"/>		
	Papillomatosis <input type="checkbox"/>	YES <input type="checkbox"/>	or	
	Lymphangiomas <input type="checkbox"/>		ActiLymph® Hosiery Kit <input type="checkbox"/>	

\* Activa® Leg Ulcer Hosiery Kit (40mmHg)

\*\*ActiLymph® Hosiery Kit

\*\*\*Acute cellulitis should be treated before using compression

Once the correct class of hosiery has been selected for disease severity, If limb measurements do not match stock sizes, use either Credalast® Velvet Made to Measure hosiery<sup>†</sup> or ActiLymph® Made to Measure flat knit hosiery<sup>††</sup>

Figure 1. Chronic Oedema Signs and Symptoms (CHROSS) Checker chart.

against gravity, which can cause it to flow backwards. When this happens, one-way valves present in the veins close to prevent backflow of blood (Anderson, 2006; 2008) (Figure 3).

The movement of blood towards the heart from the lower limbs is encouraged by gravity when lying down or when the legs are elevated, breathing and, importantly, through the action of the calf-muscle pump (Figure 4).

### THE CALF-MUSCLE PUMP

The blood in the leg veins is pushed upwards partly by the action of the foot and by the calf muscle pump as the leg moves (Lindsay et al, 2003). When the leg moves, the calf muscle contracts and squeezes the deep vein, opening the valves and forcing the blood up towards the heart. As the calf muscle relaxes, the valves close and create a negative pressure as the section between valves empties. This negative pressure draws blood from the superficial veins, through the perforators to refill the chamber ready for the next contraction of the calf muscle (Meissner et al, 2007). This mechanism, which again sends blood upwards, is particularly important in the legs, because when standing, blood has to travel a long way against gravity to return to the heart.

### THE LYMPHATIC SYSTEM

The lymphatic system has an important role in maintaining fluid



Figure 2. The veins of the lower limb.

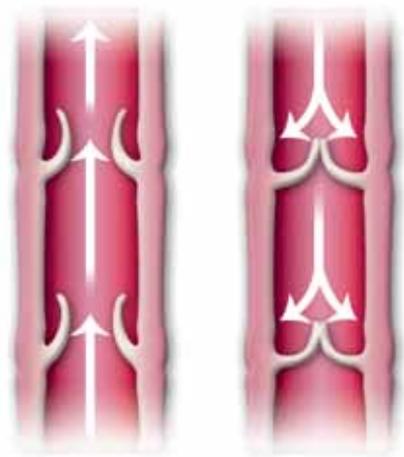


Figure 3. One way valves in the veins of the leg prevent the backflow of blood.

balance. It carries excessive tissue fluid, fats absorbed from the digestive system and proteins that leak from the capillaries back to the general circulation, otherwise they would accumulate in the tissues as oedema (Starr et al, 2008).

The fluid that circulates the lymphatic system is known as lymph and has an important immunological function — carrying foreign particles and cellular debris to the lymph nodes (Starr et al, 2008).

Lymph capillaries are present in the tissues of all organs. They have no open end in the tissues, and extracellular fluid simply diffuses into the vessels through gaps in the capillary wall (Starr, 2008).

Like veins, lymph vessels also have smooth muscle in their walls and flap-like valves that prevent backflow. Breathing and movement of muscle helps to move lymph through the lymphatic system.

Lymph nodes are located at intervals along the lymph vessels. Macrophages within the node help to clear the lymph of bacteria, debris and other substances. All lymph passes through at least one node before being delivered to the blood stream.

Lymph vessels converge into collecting ducts that drain into the veins in the lower neck. Here, the cleansed lymph fluid is returned to the circulation (Starr et al, 2008).

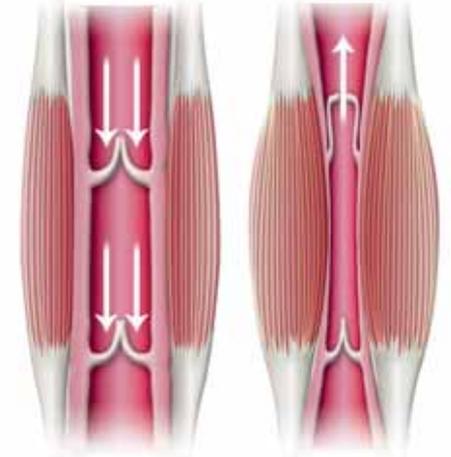


Figure 4. Action of the calf-muscle pump.

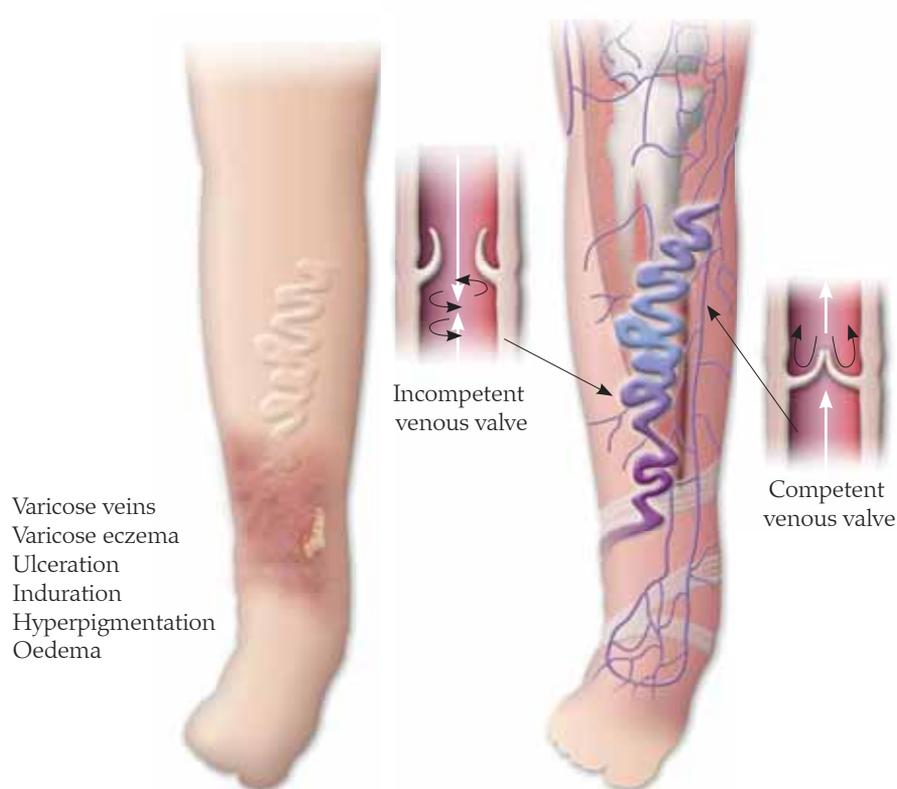
### HOW THE VENOUS AND LYMPHATIC SYSTEMS WORK TOGETHER

As blood passes through the capillaries — a process known as filtration — fluid leaks out through the semi-permeable walls and into the interstitial space that lies between the capillary wall and the tissues. This fluid is known as interstitial fluid. The exchange of nutrients, waste, fluid, electrolytes, and proteins from the vascular and lymphatic systems and tissue cells occur in the interstitial fluid.

When the venous and lymphatic systems are working correctly, the direction of fluid movement between the tissues and the blood and lymphatic systems is balanced, but when disease is present, fluid collects and results in oedema.

### WHY DO SKIN CHANGES OCCUR WITH VENOUS AND LYMPHOVENOUS DISEASE?

If the valves in the veins are damaged (e.g. due to surgery or trauma), or not working correctly (e.g. due to disease), blood will flow back down into the veins leading to an increase in blood volume and pressure (Figure 5). As a result of this venous insufficiency, the walls of the vein stretch and the pores in the capillary wall enlarge, allowing fluid, red cells and protein to leak out into the tissues. It is this process that causes some of the signs and symptoms seen as skin changes, such as hyperpigmentation and oedema (Figure 5). Prolonged leakage can



**Figure 5.**

*Skin changes occurring as a result of venous insufficiency. If the venous valves are competent, blood is prevented from flowing backwards on relaxation of the calf muscle. However, if there is valvular incompetency, blood flows backwards causing venous congestion and high pressure in the veins, which ultimately result in skin changes.*

trigger inflammatory processes in the tissue, which results in skin changes such as induration, varicose eczema and lipodermatosclerosis.

The increased volume of blood also puts extra pressure on the perforating and superficial veins. As these veins stretch, their valves do not close properly so they can no longer prevent a backflow of blood. The volume of blood within the veins increases further, raising blood pressure in the vein, causing it to stretch and resulting in more fluid leaking out into the tissues. Stretching of the veins leads to their becoming varicose. The lymphatic system then becomes unable to cope with the extra volume of fluid, leading to a worsening of oedema and chronic high blood pressure in the vein (venous hypertension). This is the main underlying cause of venous leg ulceration and lymphovenous oedema.

Severe skin changes, such as leg ulceration, or swollen or wet leaky legs, can have a huge negative impact upon patient quality of life, and can lead to social isolation and depression (Persoon et al, 2004; Jones, 2008).

Furthermore, these outcomes are costly in terms of treatment and carry an increased risk of the development of complications, including cellulitis (Anderson, 2006; 2008). Once a patient contracts cellulitis, they are at increased risk of further episodes, which can result in admission to hospital and associated spiralling costs (Clinical Resource Efficiency Support Team [CREST], 2005).

Such severe signs and symptoms of venous and/or lymphatic disease generally do not occur out of the blue, but begin as mild skin changes that can become worse with time if the underlying failure of the venous and lymphatic systems is left unchecked. However, if these skin changes are recognised as signs that the venous and lymphatic systems are not working normally, further assessment of the patient will allow a management plan to be put in place that prevents or delays the worsening of the condition.

## THE CHROSS CHECKER

The CHROSS Checker chart (Figure 1) allows an easy three-step approach to

identifying signs of venous/lymphatic disease during skin assessment, and aids the user in selecting an appropriate compression product to manage the limb(s), according to disease severity, as part of an overall care plan.

An article by Bianchi and Timmons (2008) first outlined the concept of skin changes and disease progression. Following a consensus meeting of clinical experts, they identified key skin changes that occur as a result of venous/lymphatic disease, and graded them according to severity and a need for preventive, early/moderate or intensive intervention. The CHROSS Checker takes these principles and presents them in a simplified three-step chart that is quick and easy to use in clinical practice.

The CHROSS Checker should be used as part of holistic patient assessment, to raise awareness and detection of skin changes on the lower limb. It can be used while assessing any patient to identify the early signs of venous disease, the worsening of skin changes, or for advanced skin changes and severe symptoms presented for the first time. Even the most severe skin changes can be improved through correct management, so it is never too late to identify them and intervene.

For clinicians unfamiliar with any of the conditions listed on the chart, CHROSS Checker key cards are available, providing further information on each of the conditions, including a photograph of the skin change, a description of the condition, a brief explanation of its cause (Figure 6) and, on its reverse, the compression management strategy recommended (Figure 7). The signs/symptoms listed on the key cards are colour-coded according to their presentation on the chart (green for those requiring preventative management, orange for early/medium intervention and red for intensive management), for quick referencing.

When using the CHROSS Checker in conjunction with holistic patient assessment, the clinician can systematically examine the limb for skin changes and implement treatment if appropriate.

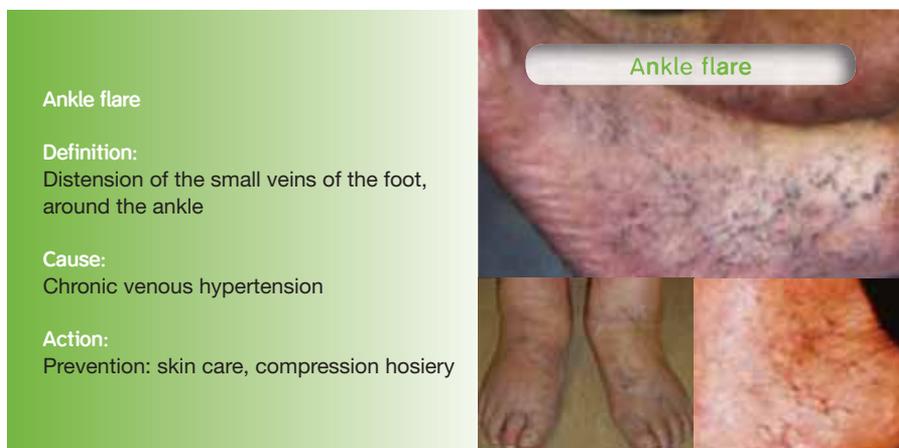


Figure 6.  
CHROSS Checker key card (front) showing information on ankle flare.

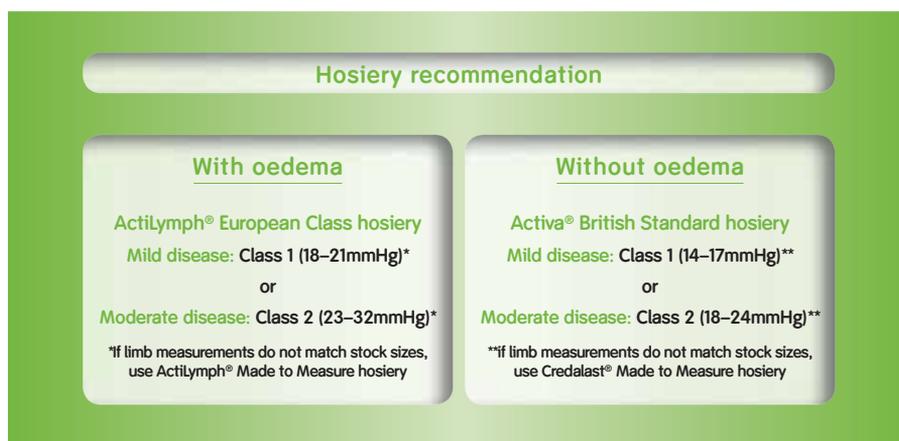


Figure 7.  
CHROSS Checker key card (reverse) showing information on ankle flare.

## HOW TO USE THE CHROSS CHECKER

### Step 1

As part of holistic assessment, the patient's skin and limb should be examined for the signs listed on the CHROSS Checker chart. If any are present, they should be ticked accordingly. For example, if the limb presents with ankle flare, this box should be ticked in column 1 (Figure 8). If the user requires further information, the CHROSS Checker key cards can be consulted (Figures 6 and 7).

If multiple signs and symptoms are present, the tick at the lowest point of the chart represents the most severe condition and it will fall into a coloured background that indicates if preventative (green), intermediate (orange), or intensive (red) management is required.

### Step 2

Within the colour band of the lowest

tick, move across into the step 2 column. Step 2 confirms the presence or absence of chronic oedema. In the example provided (Figure 8), ankle flare is present without oedema, so the 'no' arrow in the green-coloured box should be checked and followed across into the step 3 column (Figure 8).

### Step 3

Step 3 is where a recommendation is made of the most appropriate hosiery to manage the skin changes seen, as part of an overall care plan. In the example of ankle flare without oedema, given in Figure 8, the recommendation would be Activa British Standard hosiery class 1 (14–17mmHg) if mild disease is present, or class 2 (18–24mmHg) for moderate disease. Although the cards provide a guide, it is the responsibility of the clinician to use their judgement and expertise to grade the severity of disease present, and make an appropriate hosiery selection based upon this.

These compression recommendations are repeated on the

reverse side of the key cards (Figure 7), so that both parts of the kit can be used together or separately in practice.

## WHY USE COMPRESSION TO MANAGE SKIN CHANGES?

Compression therapy is a key component of managing venous and lymphovenous disease (Hardy, 2010). It enhances the functioning of the calf muscle pump and also helps to close faulty veins on calf muscle relaxation, preventing the backflow of blood. As a result of these actions, it improves venous return and helps to redistribute blood and fluid from the lower limb back into the central sections of the body, reducing venous congestion and blood pressure (Torra i Bou and Moffatt, 2008). Compression has been seen to relieve the symptoms of venous and lymphovenous disease and accelerate the healing rate of venous ulcers, thereby improving the general skin condition of the patient (Moffatt, 2007). It is also known that compression can improve lymphatic transport and re-absorption of lymph into the lymphatic system (Foldi et al, 2006).

In limbs with chronic oedema, and/or leg ulceration, compression bandaging (most commonly short-stretch [inelastic]) is usually used to reduced limb volume and promote healing. Once limb volume has reduced and/or ulceration healed, compression hosiery is commonly prescribed to maintain limb volume and shape, and to prevent ulcer recurrence (Hardy, 2006). If hosiery is not used following intensive therapy episodes, the improvements gained may be compromised (Timmons and Bianchi, 2008). For patients with limbs that do not fit standard sizes, made-to-measure products are available.

## COMPRESSION HOSIERY

There now exists a large range of compression hosiery garments which can be used at all stages of venous and lymphatic disease development. For patients with early stage skin changes and no oedema who require preventative treatment, the use of British Standard hosiery is appropriate. British Standard hosiery is lighter and cosmetically acceptable, with many different styles

Tick the box below if the sign/symptom is reported by, or present on the limb of, the patient	Is oedema also present? Tick yes or no (in the colour band of the lowest tick in step 1)	Consider application of the compression below, depending on disease severity (mild, moderate or severe) as part of management
Tired, aching, heavy legs <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	<b>Activa® British Standard hosiery†</b> Mild: Class 1 (14–17mmHg) <input checked="" type="checkbox"/> or Moderate: Class 2 (18–24mmHg) <input type="checkbox"/>
Spider veins <input type="checkbox"/>		
Mild varicose veins <input type="checkbox"/>		
Ankle flare <input checked="" type="checkbox"/>	YES <input type="checkbox"/>	<b>ActiLymph® European class hosiery††</b> Mild: Class 1 (18–21mmHg) <input type="checkbox"/> or Moderate: Class 2 (23–32mmHg) <input type="checkbox"/>
Mild hyperkeratosis <input type="checkbox"/>		
Moderate varicose veins <input type="checkbox"/>		
Hyperpigmentation <input type="checkbox"/>		
Venous dermatitis <input type="checkbox"/>		

Figure 8. The three steps to using the CHROSS Checker chart to get a hosiery recommendation for a patient with ankle flare and no oedema.

and colours available to help with patient concordance (Bianchi and Timmons, 2008).

If oedema is diagnosed, European Class hosiery garments can be used to prevent recurrence or deterioration, once limb volume has been reduced using bandaging. The action of European Class garments is more likely to encourage lymphatic movement and reabsorption of the lymph in the vessels and contain oedema, due to their having greater stiffness that comes from the yarns and the knitting process used during manufacture (Bianchi and Timmons, 2008). Patients with limbs that are severely swollen may not fit into standard hosiery sizes and will require made to measure garments. These are usually constructed using thicker and firmer material that helps to effectively contain the limb.

For all patients with venous or lymphovenous disease, compression should be used as part of an overall treatment plan which, depending on the underlying medical condition and

skin changes present, may consist of medical management, skin and wound care, exercise, manual lymphatic drainage (MLD) and patient education.

### CONCLUSION

The CHROSS Checker tool kit (Figure 9) provides a quick and easy way to evaluate skin changes as part of holistic patient assessment, and provides clear guidance on the selection of compression products to delay disease progression in patients with venous and lymphovenous dysfunction. **JCN**

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# CHROSS Checker

By recognising early changes, disease progression can be prevented or slowed...

...with a little bit of detective work.



Figure 9. The CHROSS Checker tool kit is available on request from Activa Healthcare.

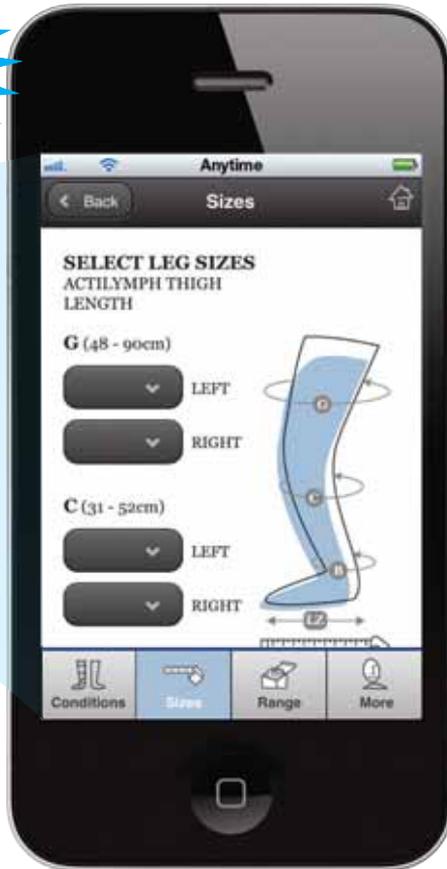
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