Classification and Treatment of Leg Ulcers using Compression Therapy
Overview

This module seeks to classify and diagnose venous, arterial and "mixed aetiology" leg ulcers. It details methods and issues in management of compression therapy, as well as focussing on improving patient quality of life. The latter parts of the module focus on 3M™ Coban™ Compression System and 3M™ Coban™ 2 Layer Compression System as well as introducing 3M™ Coban™ 2 Layer Lite Compression System.

Photocopies/downloads may be made for local use e.g. for teaching or for use with patients.
## Classification

Leg ulcers are defined as a wound below the knee of more than 6 weeks duration and can be classified according to their aetiology:

<table>
<thead>
<tr>
<th>Leg ulcer type</th>
<th>Aetiology</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| Venous         | • Venous disease – malfunctioning of the valves connecting the superficial and deep veins \(^{[020]}\)  
• 70% of leg ulcers are venous or mixed venous and arterial \(^{[021]}\) | • Swelling of leg \(^{[020]}\)  
• Surrounding skin is dry, itchy and sometimes brownish – eczema may appear \(^{[020]}\)  
• Commonly present as a weeping superficial wound  
• Often located just above the ankle, typically on the inside of the leg \(^{[020]}\) |
| Arterial       | • Arterial disease – narrowed arteries can lead to poor blood circulation \(^{[020]}\)  
• Account for approximately 20% of leg ulcers \(^{[021]}\) | • Feet and legs may feel cold and have a whitish or bluish, shiny appearance \(^{[020]}\)  
• May be painful – pain increases at rest and when legs are elevated |

When venous and arterial disease is present the ulcer maybe classified as having an arterial component or as mixed aetiology.
## Diagnosis

All patients presenting with a leg ulcer should be assessed for arterial disease by means of Doppler measurement of the ankle brachial pressure index (ABPI).

<table>
<thead>
<tr>
<th>Ulcer type</th>
<th>Description</th>
<th>ABPI range</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous ulcer</td>
<td>A leg ulcer in the presence of venous disease</td>
<td>&gt;0.8</td>
<td>• Suitable for high compression</td>
</tr>
<tr>
<td>Arterial ulcer</td>
<td>A leg ulcer in the presence of arterial disease</td>
<td>&lt;0.5</td>
<td>• Not suitable for compression</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Referral to a vascular consultant</td>
</tr>
<tr>
<td>Mixed venous and arterial ulcer</td>
<td>A leg ulcer in the presence of venous and arterial disease</td>
<td>0.5 - 0.8</td>
<td>• May be suitable for reduced compression</td>
</tr>
</tbody>
</table>

Patients with an ABPI >1.3 may require further investigation, as calcification of blood vessels may prevent an accurate ABPI reading \[035\].
Arterial leg ulcers

Arterial leg ulcers are caused by disrupted blood circulation. The arteries fail to deliver oxygen and nutrients to the lower limbs, resulting in cell death and tissue breakdown.

Arterial blood circulation may be disrupted by:

- An accumulation of fatty substances in the vessel wall, resulting in blockage
- Surgical trauma

Characteristics of arterial leg ulcers include:

- “Punched-out” appearance
- Reduced ankle brachial pressure index

Treatment can involve surgical intervention and local wound management.
Venous leg ulcers

Venous ulcers are:

- Caused by venous valve incompetence and calf muscle insufficiency which leads to venous stasis and hypertension
- A wound below the knee of more than 6 weeks’ duration

Elderly people, especially women, are particularly at risk of developing venous leg ulcers.
Assessment

Accurate assessment is crucial for effective ulcer management.

Venous leg ulcers often occur in conjunction with other medical illnesses such as arterial insufficiency and diabetes, which may affect treatment.

Ulcer assessment should typically involve:

- A comprehensive review of medical history and thorough physical examination to identify possible causes of ulceration
- An investigation of arterial blood flow – to examine concurrent arterial disease, which has a major impact on treatment
Management

Damaged valves cannot be repaired – therefore, venous hypertension and ulceration are managed by controlling or compensating for the damage [036].

Compression therapy is the most important aspect of treatment [037] and involves the application of sustained external pressure to the lower leg [036].

Compression therapy reduces the diameter of the veins and supports the function of the valves and the calf muscle pump [036].

Treatment may also include:

• Localised wound management, including wound bed preparation [014]
• Skin care – emollient therapy [037, 038]
• Elevation of the leg to reduce oedema [014]
• Encouragement of mobility to increase calf muscle pump activation [014, 037]
• Dietary intervention if the patient has poor nutrition [014]
• Psychological support [014]
✓ **Learning Objective 1** You should now be able to: demonstrate appropriate knowledge in the holistic assessment of patients with active or potential leg ulceration
Compression therapy

The efficacy of compression therapy in improving venous blood flow and reducing oedema in patients with venous leg ulcers is dependent on a number of factors:

- The use of compression stockings can maintain compression after initial treatment and help prevent recurrence
- In-elastic compression delivers a lower resting pressure but, due to bandage stiffness, creates peak pressures during movement

An ideal compression system should offer a tolerable resting pressure combined with adequate stiffness to deliver intermittent peak pressures for venous closure.
Bandaging techniques

Traditional bandaging techniques used in compression therapy focus on achieving sustained graduated pressure [036, 042, 043], however:

- Graduation is not always seen in practice
- Highest values have been noted at the calf muscle area

The Charing Cross four-layer compression system has been used in the UK since the 1980s for the care of patients with venous leg ulcers [040].

While four-layer compression systems remain popular in the UK, short stretch and multilayer systems with fewer layers are increasingly used [044].

Reduced layer systems are associated with patient concordance benefits [045].

Increasing evidence suggests that two-layer systems are as effective as four-layer systems and provide more reproducible levels of compression [043, 046].
Measuring compression

It is often stated that a pressure of 40/17mmHG (ankle/calf) should be achieved by clinicians.

Sub-bandage interface pressures are predicted by Laplace’s Law[^49], however:

- It is predicted application pressure[^49]
- It is an interface pressure not an intra-limb pressure[^49]
- It does not account for variations in patients’ tissue density and oedema/calf muscle tone, as it assumes that the limb is rigid and spherical[^49]

Trials have demonstrated that in research settings, clinicians were unable to apply graduated compression in accordance with Laplace’s Law[^36, 043].
The Static Stiffness Index

The Static Stiffness Index (SSI) is an assessment of interface pressure and stiffness:
- Interface pressure is the force of the compression material on the surface [039]
- Stiffness characterises the elasticity of the compression device [039]

The SSI is calculated using the difference between the bandage interface pressure when standing and when lying mmHg. The pressures should ideally be measured at a lower leg level [039].

Uses of SSI:
- Useful parameter in measuring the elastic properties of compression systems – especially in those made from several materials [041]
- Demonstrates the force available for the calf muscle pump to work against

Suitable bandage stiffness delivers intermittent peak pressures, supporting vein/valve closure and venous return, but the resting pressure during sitting and lying should be in a comfortable range [039].

Compression systems with a high SSI have a high working pressure when standing and a lower, more tolerable, resting pressure when lying [039].
Learning Objective 2

✔ Learning Objective 2 You should now be able to: explain the theory behind compression therapy
Issues in venous leg ulcer management

The success of compression therapy depends largely on patient compliance – they should be encouraged to mobilise as much as possible to assist venous return.

Ulcer recurrence is common and patients require life-long therapy.

The use of compression stockings can maintain compression after initial treatment and help prevent recurrence.

Venous ulcers may be complicated by the presence of other illnesses:

• Patients with concurrent arterial insufficiency cannot be treated with high compression bandaging as this can further reduce arterial supply and lead to wound deterioration
• Before treatment, arterial status should be assessed with Doppler ultrasonography
Quality of life in patients with leg ulcers

Studies suggest that patients with chronic venous ulcers perceive their quality of life as poor [025, 053]. The negative effects of venous leg ulcers fall into three main areas – psychological, physical and social:

<table>
<thead>
<tr>
<th>Psychological Factors</th>
<th>Physical Factors</th>
<th>Social Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Hopelessness</td>
<td>□ Pain</td>
<td>□ Altered working life</td>
</tr>
<tr>
<td>□ Helplessness</td>
<td>□ Sleeplessness</td>
<td>□ Diminished interaction</td>
</tr>
<tr>
<td>□ Lack of control</td>
<td>□ Impaired mobility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Lack of explanation or empathy</td>
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</table>

Appropriate management of venous leg ulcers, including a good compression system, can lead to improvements in both patient quality of life and clinical outcomes [052].
Improving quality of life

Traditionally, four-layer bandaging systems – often fairly bulky, uncomfortable and socially unacceptable for patients – have been part of the evidence-based care of leg ulcers [045].

A conflict may often arise between the clinician’s will to cure the ulcer completely and the patient’s desire to manage their pain and normalise their life [055].

Newer two-layer technologies are becoming more widely available and early trials suggest:

- Greater ease of application and simpler training [046]
- Equally effective levels of compression (reproducibility) [043, 046]
- Less bandage slippage [045]
- Greater social acceptability for the patient [043, 045]
What do each of the 4 Layers in compression bandaging do?

The traditional layers of the Charing Cross 4 layer compression system are detailed below:

Orthopaedic wool - padding (protects bony parts) comfort, absorbs exudate and helps with reshaping limb - to ensure distribution of pressure.

Crepe - adds absorbency, smooths the orthopaedic wool.

Elastic layer - first layer of compression - provides light compression

Cohesive layer (where regular 3M™ Coban™ Compression System is used) - provides second layer of compression - providing additional compression and helping to maintain bandage in situ and/or reduce slippage.
Why 2 layers instead of 4?

Previous studies completed using the 3M™ Coban™ 2 Layer Compression System show:

• Comparable healing and wound size reduction in a randomised crossover trial to 4 layer systems.

• Significant difference in patient quality of life compared to 4 layer systems.

• Simple to apply with fewer components and application times up to 30% quicker.

• Fewer layers result in a less bulky bandage, improving comfort and mobility.

• Improved patient comfort results in improved patient concordance.

• Application technique is easy to learn and the potential for inappropriate application is diminished.
What primary dressings can be used under compression bandaging?

Simple non adherent dressings should be used. Which one is chosen will depend on the level of exudate. For moderate to highly exuding wounds an alginate or hydrofiber primary dressing can be used in addition to a secondary foam or silicone dressing. If the wound is lightly exuding a contact layer dressing would be most appropriate.
The 3M™ Coban™ and Coban™ 2 Layer Lite Compression Systems introduce a new level of comfort, effectiveness and convenience for you and your patients. It gives all the benefits of a four-layer system and is not short-stretch.

Coban and Coban 2 Layer Lite compression systems are latex-free compression systems used to achieve sustained therapeutic compression for the treatment of venous leg ulceration and related conditions.

Coban 2 Layer Lite compression system is similarly designed to achieve sustained therapeutic compression, but with reduced sub-bandage resting pressures. It is used for the management of mixed aetiology leg ulcers, lymphoedema and venous leg ulcers, where patients cannot tolerate full compression, or where full compression is otherwise inappropriate.
Each kit contains 2 rolls:

- **Layer 1** – the inner comfort layer. The unique foam comfort layer is latex-free and replaces the orthopaedic wool layer
- **Layer 2** – the outer compression layer. The cohesive compression layer provides effective, sustained compression

Once applied, the two layers bond together to form a low profile, single layer bandage that is designed to resist slippage.

Rolls have different coloured cores for easy identification:

- Coban 2 Layer compression system - purple core
- Coban 2 Layer Lite compression system - green core
Learning Objective 3

✓ Learning Objective 3 You should now be able to: identify the management and treatment options available
Indications for use

The Coban 2 Layer compression system is indicated for use in the management of:
- Venous leg ulceration
- Related conditions, including lower leg oedema, where an ulcer is present

Coban 2 Layer compression system is suitable for patients with an ABPI >0.8.

The Coban 2 Layer Lite compression system is indicated for use in the management of:
- Mixed aetiology leg ulcers
- Lymphoedema
- Venous leg ulcers where reduced compression is appropriate

Coban 2 Layer Lite compression system is suitable for patients with ABPI >=0.5.
Key Benefits for Health Care Providers

All patients presenting with a leg ulcer should be assessed for arterial disease by means of Doppler measurement of the ankle brachial pressure index (ABPI).

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| • Latex-free – reduces allergy risk  
• Applied using a full-stretch technique  
• Reduced potential for application error[^110]  
• Provides more consistent pressure values[^043]  
• Supplied as a kit | • Simplified application and removal requires minimal training[^043]  
• Fewer layers to apply  
• Effective compression for up to 7 days, requiring reduced frequency of change[^111] |
Key Benefits for Patients

Here are the key benefits for patients:

- Normal footwear can be worn
- Reduced slippage
- Improved patient concordance to treatment
- Encourages maintenance of mobility and social activity
- Latex-free – reduces allergy risk
- Improved patient comfort
- Less bulky and lightweight for increased comfort
Learning Objective 4

✓ **Learning Objective 4** You should now be able to: recognise the key benefits of the 3M Coban 2 Layer Compression System in patient care
Thank you

For more information and for support in training on the application of 3M™ Coban™ 2 Compression System please contact your local 3M representative directly or via your local 3M website.
# References

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<td>Douglas V. (2001) &quot;JWC.&quot;;10(9)355-360</td>
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<td>Arrowsmith M. (May 2006) &quot;The impact of a new 2-layer compression system on patient concordance when used in the treatment of chronic venous leg ulcers.&quot; #104. Poster presented at the 16th conference of the European Wound Management Association, Prague, Czech Republic</td>
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