# Table of Contents

Overview of Lymphedema.................................................................2–3
  Lymphatic Anatomy and Function..............................................2  
  Fluid Balance..............................................................................3  
  Lymph Flow.................................................................................3

Overview of Lymphedema Treatment..............................................4  
  Effects of Bandaging as One Component of Intensive Care ..........4  
  How 3M™ Coban™ 2 Compression System Provides Short Stretch Benefits ....................................4

3M Materials Science and Lymphedema Bandaging.......................5–9  
  New 3M Materials........................................................................5–6  
  Evidence to Support Use of New Materials for Lymphedema Treatment ....6  
  Effective Compression ................................................................7  
  Conformability Without Additional Padding...............................8  
  Mobility and Function ...............................................................8  
  Proven Safe for Skin...................................................................9

3M Product Offering.......................................................................10–12  
  Product Line.................................................................................10  
  Typical Products Used for Arm, Hand, Finger and Toe Applications ...11  
  Typical Products Used for Leg and Foot Applications...............11  
  Easy-to-Remember Reference Numbers.................................12  
  Ordering Information ..............................................................12

Application Details — Basic Techniques.........................................13–18  
  Hand and Arm...........................................................................13–15  
  Leg and Foot.............................................................................16–18

Frequently Asked Questions.........................................................19–22

References ..................................................................................23
Overview of Lymphedema

Lymphedema is a chronic condition resulting from congenital defects or secondary damage due to surgical disruption, radiation, or trauma to the lymphatic system. Lymphedema is characterized by swelling (edema) due to the build-up of lymph fluid in the tissues just under your skin. The swelling, seen most often in the arms or legs, may involve the face, neck, abdomen (belly), and genitals.

Lymphatic Anatomy and Function

The lymphatic system is one of the three circulatory systems in the human body. Much is known about the arterial and venous system and only recently has more attention been spent on understanding the lymphatic system which plays a vital role in the balance of fluids in our body.

The lymphatic system functions to balance our tissue fluid pressures by reabsorbing protein-rich fluids and waste products that escape from the bloodstream into the interstitial space.

The normal lymphatic system is described as a one-way system where tiny lymphatic capillaries start blind-ended in the tissues where they are attached to the skin by anchoring filaments. These capillaries unite to form a network of wider vessels that act as a regional drainage system. As these vessels become larger, they follow a path similar to veins ultimately emptying into the venous system through two large lymph-collecting vessels. 75% of lymph fluid is collected from the left side of the body and the right leg and lower abdomen and passes into the thoracic duct. The remaining 25% of the lymph fluid is collected from the right side of the head, neck, arm and chest and is passed into the lymphatic duct.1

This vast lymph network contains lymph nodes, located in chains or clusters that filter and remove potentially harmful bacteria, viruses and cancer cells prior to entering the venous system. The lymph nodes also produce lymphocytes, white blood cells specially designed to protect us from disease.
Fluid Balance

Fluids in the body tissues are normally kept in balance via complex interactions between the blood circulation mechanisms and the lymphatic system. Arterial blood flow brings nutrients and oxygen to the tissues and during this process fluids will pass through the capillary walls (filtration) into the tissue (interstitial) spaces. Waste products and fluids that have collected within the tissue spaces are then primarily reabsorbed back into the small, collecting veins that return the blood back to the heart.

The job of the lymphatic system is to remove any excess fluid, waste products, viruses and bacteria still trapped in the interstitial spaces (reabsorption) where it is ultimately returned to the venous circulation.

If an imbalance occurs between the fluids that accumulate in the tissue space and the rate of reabsorption, then edema occurs. There are many causes that contribute to this tissue fluid imbalance but if the lymphatic reabsorption is compromised, proteins are also trapped in the tissues increasing the concentration of the interstitial fluid. This accumulation of high protein fluids in the interstitial space is called lymphedema.

Lymph Flow

Under normal conditions, healthy lymphatic flow is supported by rhythmic contractions of the lymphangions. These are the functional segments of lymph vessels with walls of smooth muscle and with one-way valves that prevent back flow. These contractions generate enough pressures to move the fluid towards the heart. All other forces, such as muscular contractions, respiratory movements and arterial pulsations are secondary to the normal lymphatic contractions. However, Olszewski has shown that when spontaneous lymph flow mechanisms are damaged, limb muscle contractions take over the job to stimulate lymphatic contractions, subsequently increasing lymph flow, or generating intralymphatic pressures that propel the lymph.

In this study, the benefit of compression bandaging was illustrated to support the limb muscle dynamics that supported lymph flow.
Overview of Lymphedema Treatment

The ultimate goal of lymphedema management is to stimulate lymphatic flow via alternative pathways so that lymph fluid is moved from the lymphedematous regions, circumventing the damaged or obliterated normal pathways.

The traditional treatment methods will vary depending on the patient’s physical status and stage of condition. It is widely accepted that compression therapy is an effective component of lymphedema treatment.

Lymphedema is treated by a physical or occupational therapist or other health care professional with specialized training. Treatment may be accomplished in specialized clinics, hospital or community settings. The treatment, may be called complex decongestive therapy (CDT), or decongestive lymphatic therapy (DLT) or complete decongestive physiotherapy (CDP) and includes skin care, education, movement/breathing exercises, manual lymphatic drainage (MLD) and compression therapy.

Effects of Bandaging as One Component of Intensive Care
Lymphedema specialists have long recognized that inelastic bandages with low extensibility produce high working pressures and lower resting pressures creating peak pressures that produce a massaging effect to stimulate lymph flow.

Different mechanisms may explain the efficacy of compression therapy:
- Reduction in capillary filtration
- Shift of fluid into non-compressed parts of the body
- Increase in lymphatic reabsorption and stimulation of lymphatic transport
- Improvement in the venous pump in patients with veno-lymphatic dysfunction and breakdown of fibrosclerotic tissue

These beneficial effects have been further supported by Partsch who identified that compression is the most critical aspect of treatment and is most effective when inelastic materials are used.

Mayrovitz further describes the effects of short stretch bandaging to provide the required resistance to support and distribute the dynamic working pressures created by functional, muscle activities to move interstitial fluids, soften fibrotic tissues and stimulate lymphatic contractility.

How 3M™ Coban™ 2 Compression System Provides Short Stretch Benefits
The Coban™ 2 Compression System has been designed with innovative new materials that work together to create a comfortable inelastic sleeve and have been proven to support the muscle functional dynamics that support normal venous and lymphatic return and reduce edema.

Results of a multi-centre, prospective, open label, randomized controlled study showed that Coban™ 2 Compression System reapplied twice weekly is effective to reduce lymphedema.
3M Materials Science and Lymphedema Bandaging

Up until now, traditional lymphedema bandaging has incorporated short stretch, inelastic bandages with a variety of padding materials to normalize the limb shape believed to provide a pressure gradient according to Laplace’s Law. The resultant bandage creates the rigid sleeve that supports intermittent peak pressures of muscle activity to achieve the massaging effect that stimulates lymph flow. Though effective in reducing edema, these bandages create a number of distressing problems for the patient.

Traditional bandages are thick, stiff and bulky so that wearing normal clothing and footwear is difficult. Qualitative studies have reported that current bandaging methods restrict mobility, reduce flexibility and function required for the normal activities of daily living. In addition, patients have reported that the standard Multi-Layer Lymphedema Bandage (MLLB) treatment is time consuming and tiring.

New 3M Materials

3M™ Coban™ 2 Compression Systems were invented to provide many of the ideal properties described in literature of an effective compression system. Coban™ 2 Compression Systems incorporate innovative methods and patented materials to provide comfortable, sustained compression that improves lymphatic flow to reduce lymphedema. When applied to the limb, the resulting bandage creates an inelastic sleeve with the ideal stiffness to support all the muscular movements of the patient within the bandage. These intermittent muscle contraction/relaxation forces are proven to move lymphatic flow to reduce edema.

Coban™ 2 Compression Systems design properties are unique. The system is latex-free and composed of two specially designed layers:

- Layer 1, 3M™ Coban™ 2 Comfort Foam Layer, a laminate of medical grade polyurethane foam with cohesive, non-woven backing

- Layer 2, 3M™ Coban™ 2 Compression Layer, a cohesive bandage with spandex filaments modified to be short stretch and with specific numbers and denier to provide lite or high compression
The 3M™ Coban™ 2 Comfort Foam Layer is applied with the foam side towards the skin to provide comfortable cushion, protection and mechanical grip when compressed against the skin to reduce slippage during wear. 3M™ Coban™ 2 Compression Systems have been proven to be patient preferred and to provide reduced slippage.

The 3M™ Coban™ 2 Compression Layer, with short stretch properties was specifically designed to be applied at full stretch to eliminate the guesswork of applying the bandage at varying extension. This method has been shown to reduce application variability and proven to be easy to learn and easy to teach.

After application, the two layers cohere together creating a comfortable inelastic sleeve that conforms to the anatomy and grips the skin to reduce potential for uncomfortable slipping and bunching. The thin profile allows use of more normal footwear so the patient can remain as active as possible. Maintaining activity will promote reduction of edema and lymphatic return.

**Evidence to Support Use of New Materials in Lymphedema Treatment**

To expand the evidence to support use of Coban™ 2 Compression Systems for lymphedema treatment, 3M has recently completed a number of clinical and economic studies in partnership with leading clinicians. The body of work includes:

- Randomised control trial on 82 patients with arm and leg lymphedema from which application frequency, clinical outcomes and cost of total treatment were captured

- Observational case series on use of the new materials on 24 patients, and report of clinician and patient experiences

- Proof of concept study of effective volume reduction over 24 hours on 30 leg lymphedema patients

Six manuscripts are currently being prepared for publication in peer-reviewed journals and the detail results will be available once the studies have been published.

See Summary of Clinical Programs for more details.
Effective Compression

Breakthrough research\textsuperscript{7} has shown that the dynamics of effective compression therapy are better explained by Pascal’s Law, which states that when pressure is applied (functional activity) on a fluid (a muscle or muscle group) in a closed container (fascia muscularis and compression layer), there is an equal increase at every other point in the bandage.

In compression, dynamics refers to the difference between high and low working pressures reflecting intermittent changes in pressure caused by the patient’s own muscle movement within the bandage.

![Pressure Graph](image)

Inelastic or rigid compression systems generate larger dynamics, or amplitudes, and therefore, more effective compression. Mayrovitz\textsuperscript{6} showed that an inelastic external covering facilitates the lymph movement by the dynamic peak pressures generated through muscle contractions.

3M\textsuperscript{TM} Coban\textsuperscript{TM} 2 Compression Systems are engineered to create a conformable, inelastic sleeve that stays in place, is comfortable to wear and proven to support the patient’s functional activities to reduce lymphedema. Efficacy has been demonstrated by a randomized, multi-centre, prospective, open label study\textsuperscript{8} comparing Coban\textsuperscript{TM} 2 Compression System to standard bandages showed excellent volume reduction with twice weekly applications.
Conformability Without Additional Padding

In traditional lymphedema bandaging, a variety of foam and fluff padding materials have been used to protect vulnerable skin folds and normalize the shape of the limb to create a bandage with even compression that provides a pressure gradient according to Laplace’s Law. The various densities of these materials require application of multiple layers of short stretch bandages to create a certain level of “stiffness” required to support lymphatic flow.

3M™ Coban™ 2 Compression System materials were designed to provide the required “stiffness” with only two thin layers that conform directly to the patient’s limb contours. Clinical effectiveness has been proven as seen by volume and skin fibrosis reduction. If additional protection is needed, the comfort foam layer can be adapted to protect skin folds and bony prominences without adding additional bulk that would interfere with clothing and footwear.

Mobility and Function

The thin, low profile of the Coban™ 2 Compression System materials has been proven in a randomized controlled study to significantly improve patients’ Health Related Quality of Life Physical Symptoms and Daily Living Scores. Patients with lymphedema also reported an extremely positive experience wearing Coban™ 2 Compression Systems with the key advantages of lightness, neatness and flexibility enabling mobility and improving quality of life.

Lightness and Comfort

Qualitative studies have reported that current multi-layer compression bandages are bulky, uncomfortable and restrictive with a cumulative negative impact on patients’ self-esteem and self-confidence. After wearing Coban™ 2 Compression Systems, these same patients had a renewed sense of self resulting from the reduced swelling and lighter, less intrusive, flexible bandage.

Less Slippage

Coban™ 2 Compression Systems have been proven to stay in place with less slippage. The inner comfort foam layer consists of latex-free medical grade polyurethane foam laminated to a cohesive non-woven backing. When compressed, the foam grips the skin, and the non-woven backing provides a cohesive surface for the attachment of the compression layer. The patented interlocking materials cohere to each other, creating a rigid sleeve that conforms to the limb.

Clinical experience using Coban™ 2 Compression System for lymphedema treatment demonstrated that the bandages stayed in place even with clinically relevant volume reduction and that the low slippage allowed effective treatment for up to four days wear.
Proven Safe for Skin

For patients with lymphedema, maintenance of skin integrity with careful management of skin problems is important to minimize the risk of infection. 3M™ Coban™ 2 Comfort Foam Layer is a laminate of medical grade foam with a latex-free cohesive backing. The hypoallergenic foam side is applied to the skin and has been proven to be safe, non irritating, non sensitizing and can be left in place up to 7 days when clinically appropriate.

Clinical experience using 3M™ Coban™ 2 Compression System for patients with lymphedema has demonstrated effective compression for up to four days with high skin tolerance. During this same study, a wide array of skin products were used in conjunction with the Coban™ 2 Compression System and were found to be well tolerated and did not promote bandage slippage.
3M Product Offering

A variety of sizes are offered along with recommended application techniques to fit the variety of body and limb contours. There are two offerings and each has clear, differentiating labeling and colouration.

Product Line

The white Comfort Foam Layer is applied first

The tan Compression Layer is applied second

Patient Icon Roll Icon

Comfort Foam and Compression Layers Clearly Marked

The Comfort Foam Layer and Compression Layer are packaged separately so clinicians can select and customize materials to meet the size and contour challenges of every patient with lymphedema. Each individual roll is clearly marked with either a 1 or a 2, to indicate the order of application.

Easy-access Boxes Include Symbols and Icons

The easy-access boxes also include a white or coloured roll icon with a 1 or a 2 indicating the order of application. The roll icon identifies the contents as Comfort or Compression Layer materials. The patient icon indicates the correct body part for each product.

3M™ Coban™ 2 Comfort Foam Layer and 3M™ Coban™ 2 Compression Layer are provided in a wide variety of sizes for clinician choice and convenience to meet the size and contour challenges of the patient with lymphedema.

Original 3M™ Coban™ 2 Compression System materials are provided for the lower extremities as they have been proven to provide sub-bandage pressures for comfortable, effective venous and lymphatic edema reduction.

3M™ Coban™ 2 Lite Compression System materials are designed to provide short stretch inelasticity with reduced sub-bandage resting pressures. They are recommended for upper extremities, fingers and toes — all with smaller diameters. Laplace’s Law, which states that pressure is proportional to the tension of the material stretch divided by the radius \( P \propto \frac{T}{R} \) helps us understand that limbs with smaller radii require lower sub-bandage pressure for comfort and safety. For arm lymphedema, Damstra\(^1\) has reported that low-pressure bandages are as effective as high-pressure bandages with improved patient comfort.
Typical Products Used for Arm, Hand, Finger and Toe Applications

For the upper limbs, fingers and toes with smaller circumferences use 3M™ Coban™ 2 Lite Compression System identified by bright green package colour and icon.

**Typical Arm Bandage:**
- 1 roll of 2,5cm Compression Layer (2) – for fingers
- 1 roll each of 10cm Comfort Foam Layer (1) and Compression Layer (2)

**Large Arm:**
- 1 roll of 2,5cm Compression Layer (2) – for fingers
- 1 roll each of 10cm Comfort Foam Layer (1) and Compression Layer (2) – for hand and wrist area
- 1 roll each of 15cm Comfort Foam Layer (1) and Compression Layer (2) – for arm

**Foot Bandage. Individual Toe Technique:**
- 1 roll of 2,5cm Compression Layer (2)
- 4 – 2,5cm strips of Comfort Foam Layer (1)

Typical Products Used for Leg and Foot Applications

For the lower extremities use 3M™ Coban™ 2 Compression System identified by bright purple package colour and icon.

**Foot Bandage. Toe Boot Technique:**
- 1 roll each of 5cm Comfort Foam Layer (1) and Compression Layer (2)

**Typical Leg Bandage:**
- 1 roll each of 10cm Comfort Foam Layer (1) and Compression Layer (2) – for foot up to below knee
- 1 roll each of 15cm Comfort Foam Layer (1) and Compression Layer (2) to cover knee and thigh

**Large Leg:**
- 1 roll each of 10cm Comfort Foam Layer (1) and Compression Layer (2) – for foot up to below knee
- 1 roll of 15cm Comfort Foam Layer (1) to cover knee
- 1 roll of 20cm Comfort Foam Layer (1) to cover thigh
- 2 rolls of 15cm Compression Layer (2) to cover knee and thigh
Easy-to-Remember Reference Numbers

The product numbering system has been designed to help you when ordering 3M™ Coban™ 2 Compression System. The 5-digit reference numbers are set up as follows:

1 = Comfort Foam Layer  
2 = Compression Layer  
7 = Coban™ 2 Lite  
0 = Original Coban™ 2

Ordering Information

3M™ Coban™ 2 Lite  
2 Layer Lite Compression System

<table>
<thead>
<tr>
<th>Indication</th>
<th>REF #</th>
<th>Roll Dimensions</th>
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<tr>
<td></td>
<td>20716</td>
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<tr>
<td>Safe and effective for arms, shoulders, fingers and toes</td>
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<tr>
<td></td>
<td>20726</td>
<td>15cm x 3.5m 6 in x 3.8 yds</td>
<td>15</td>
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3M™ Coban™ 2  
2 Layer Compression System

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<th>Boxes/Case</th>
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<td></td>
<td>20014</td>
<td>10cm x 3.5m 4 in x 3.8 yds</td>
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<td>2</td>
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<tr>
<td></td>
<td>20016</td>
<td>15cm x 3.5m 6 in x 3.8 yds</td>
<td>10</td>
<td>4</td>
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<tr>
<td>Safe and effective for legs, hips and torso</td>
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<td>2</td>
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<tr>
<td>Compression Layer</td>
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<td>5cm x 2.7m 2 in x 3 yds</td>
<td>32</td>
<td>4</td>
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<tr>
<td></td>
<td>20024</td>
<td>10cm x 4.5m 4 in x 4.9 yds</td>
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</tr>
<tr>
<td></td>
<td>20026</td>
<td>15cm x 4.5m 6 in x 4.9 yds</td>
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</tr>
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</table>
# 3M™ Coban™ 2 Lite Compression System Application for the Hand and Arm

## Application of Comfort Foam Layer to Hand and Arm

### Materials & Positioning
- Position the arm with the elbow in slight flexion (135°) and the fingers spread widely with the hand positioned palm down. This supports the arm in a comfortable, functional position.
- Select the 10cm (4 inch) 3M™ Coban™ 2 Lite Comfort Foam Layer and 3M™ Coban™ 2 Lite Compression Layer for most hands and arms.
- If the arm is large, a roll each of 7.5cm (3 inch) or 10cm (4 inch) Coban™ 2 Lite Comfort Foam Layer and 3M Coban™ 2 Lite Compression Layer can be used for the hand and 15cm (6 inch) should be used to cover the arm.
- When the fingers are going to be bandaged, apply the comfort foam layer only on hand and wrist, rather than to apply it to the entire arm. After the finger application, bandage the remainder of the arm. This results in a smooth and wrinkle-free application of the comfort foam layer on the entire arm, especially in the elbow region.

### Application Details—Basic Techniques

<table>
<thead>
<tr>
<th>Layer 1: Comfort Foam Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Apply this layer with the foam side against the skin, using just enough tension to conform to the shape of the arm with minimal overlap.</td>
</tr>
<tr>
<td>• Cover the skin with as thin a layer as possible with no gaps.</td>
</tr>
<tr>
<td>• When skin folds (aprons) are present, use pieces of comfort foam layer folded with foam side out to separate them.</td>
</tr>
<tr>
<td>• If the arm is large and the top edge tends to roll, you may add stability by applying an extra winding of comfort foam layer.</td>
</tr>
</tbody>
</table>

### Step 1:
Start with a circular turn from the radial side of the arm, running dorsally. Centre the beginning of the material on top of the radial styloid.

### Step 2:
Make a circular turn and direct the material towards the knuckle of the fifth finger.

### Step 3:
Cover the palm of the hand.

### Step 4:
Make a proximal cut so that the end is in the first web space.

### Step 5:
Come across the dorsum of the hand so that the distal border lies at the level of the knuckles.

### Step 6:
Lay the flaps at the base of the thumb smoothly. Cover the flaps with the next circular winding. **NOTE:** If fingers are going to be included, apply the comfort foam layer only on hand and wrist. Complete finger wrapping before proceeding to wrap arm (See “Application for Fingers”).

### Step 7:
Proceed towards the elbow with circular windings. Keep the overlaps as minimal as possible. Make sure that no edges lie along the elbow crease.

### Step 8:
Continue windings to the top of the arm. If the anatomy of the arm does not allow a smooth application, the material can be cut and restarted at any time. **NOTE:** If the arm is large and the top edge tends to roll, you may add stability by applying an extra winding of comfort foam layer.

### For Additional Stability or Comfort

- **Step A:** To provide extra stability in the elbow, an extra layer can be positioned longitudinally.
- **Step B:** Two small slits allow easy conformability.
- **Step C:** This layer is molded to the anatomy.
3M™ Coban™ 2 Lite Compression System Application for the Hand and Arm (Cont.)

**Application Details—Basic Techniques**

### Application for Fingers

**Step A:** As you end the comfort foam layer application to the hand and wrist (see Steps 1–6 from “Application of Comfort Foam Layer to Hand and Arm”), apply light pressure and cut off the excess material. Light pressure applied at the end of the bandage ensures that it stays in place during application of the compression layer. The end of the comfort foam layer may be temporarily secured with tape.

**Step B:** Prepare a web spacer to protect the finger web spaces. Fold a piece of 10 x 25cm comfort foam layer in half. On fold, make two triangle cuts with top slits to create openings for fingers. Trim outer edges to follow thumb and hand contours.

**Step C:** Apply the web space protector with the third and fourth finger through the openings.

**Step D:** Overlap and mold the edges in the thumb web space.

**Step E:** Mold the layers together to conform to the shape of the hand.

**Step F:** Using the 2.5cm Lite compression layer roll, wrap each finger individually beginning distally. Apply layers at full stretch after the first circular winding with “relax-breaks” where, after each semi-circular winding, that piece is molded to the underlying layer. A rigid sleeve is then provided with comfortable pressure. Sequence: stretch—press and mold—relax.

**Step G:** When finishing the first finger, make a circular winding to provide an anchor for further finger bandaging. Cut and restart for each finger.

**Step H:** Wrap the remaining fingers as in Step F. The cohesive properties of the material allow fan folding to cover the proximal finger areas without the need for multiple circular windings around the hand. As you end the application apply light pressure and cut off the excess material.

**Step I:** After the fingers have been wrapped, mold the application to the anatomy of the hand.

**Step J:** Continue with the application of the comfort foam layer to arm (see Steps 7 and 8 from “Application of Comfort Foam Layer to Hand and Arm”).

### Web Spacer for When the Fingers are NOT Included

**Step A:** When the fingers are not included, protect the thumb web space with a double layer of comfort foam layer.

**Step B:** Trim the protector to allow full thumb function.
Layer 2: Compression Layer

- Apply even compression with at least two layers. Even compression is best achieved when the material is applied at full stretch.
- It is recommended that you hold the roll close to the hand and limb throughout the application for controlled, even compression.
- If “bulges” are noted after the application, apply additional compression layer until the limb appears smooth.

Step 9: Start with a circular turn from the radial side of the arm, running dorsally. Centre the beginning of the material on top of the radial styloid.

Step 10: Make a circular turn and direct the material towards the knuckle of the 5th finger and cover the palm of the hand.

Step 11: Make a proximal cut in the material so that the end is in the first web space.

Step 12: Position the flaps together at the base of the thumb and mold smoothly.

Step 13: Come across the dorsum of the hand so that the distal border lies at the level of the knuckles.

Step 14: Come across the palm again making a cut similar to the previous one, to accommodate the thumb. Position the flaps together at the base of thumb and mold smoothly.

Step 15: The next circular winding runs to the base of the thumb, covering the positioned flaps.

Step 16: Proceed towards the elbow with circular windings with at least 50% overlap.

Step 17: Cover the elbow joint with circular windings or figures of eight as needed to conform and ensure that no edges lie along the crease.

Step 18: Continue winding to the top of the arm.

Step 19: Stop the compression layer application just below ending of the comfort foam layer. As you end the application apply light pressure and cut off the excess material.

Step 20: Mold the entire application to conform to the anatomy. NOTE: If the bandage rolls at the upper edge of large arms, additional stability of the bandage is achieved by applying the compression layer in a spica (figure of eight) pattern to the shoulder.

Bandage Removal
Dipping the scissor tips into cream allows comfortable and easy bandage removal.
3M™ Coban™ 2 Compression System
Application for the Leg and Foot

Materials & Positioning
- For many patients, it is necessary to apply the full leg application in two stages.
- Apply the lower limb bandage with the patient sitting or lying comfortable and then have the patient stand to apply the upper leg bandaging.
- For full benefit of compression therapy, it is important that the leg is supported in a relaxed position throughout the entire application.
- If a wound is present, foam dressings are most effective to manage exudate.
- Select the 10cm (4 inch) 3M™ Coban™ 2 Comfort Foam Layer and 3M™ Coban™ 2 Compression Layer for most lower legs.
- 15cm (6 inch) or 20cm (8 inch) Coban™ 2 Comfort Foam Layer and Coban™ 2 Compression Layer should be used to cover the knee and thigh.

Application for Below the Knee

Layer 1: Comfort Foam Layer
- Apply this layer with the foam side against the skin, using just enough tension to conform to the shape of the leg with minimal overlap.
- Cover the skin with as thin a layer as possible with no gaps.
- When skin folds (aprons) are present, use pieces of comfort foam layer folded with foam side out to separate them.

Step 1: With the foot in a 90° dorsiflexed position, start the application with a circular winding at the base of the toes, beginning at the fifth metatarsal head. Beginning at the fifth toe provides neutral, comfortable foot alignment.

Step 2: The second circular winding should come across the top of the foot so that the middle of the bandage width approximately covers the articulating aspect of the ankle joint. Bring this winding around the back of the heel and lay it over the top of the foot where it overlaps the underlying material.

Step 3: Cut the wrap and gently press into place. The posterior plantar surface of the foot is not completely covered.

Step 4: With minimal overlap, and with just enough tension to conform smoothly along the contours, wind the bandage around the ankle and proceed up the leg applying the layer in the direction the roll takes you. NOTE: Individual windings may be used for highly contoured legs.

Step 5: The top of the bandage should end just below the fibular head, or two fingers width below the crease at the back of the knee. Bring the bandage back down the leg to cover all areas of the skin. To ensure as thin a layer as possible, try to minimize the areas of overlapped material.

Layer 2: Compression Layer
- Apply even compression with at least two layers. Even compression is best achieved when the material is applied at full stretch.
- It is recommended that you hold the roll close to the foot and limb throughout the application for controlled, even compression.
- If “bulges” are noted after the application, apply additional compression layer until the limb appears smooth.

Step 6: Light pressure applied at the end of the bandage ensures that it stays in place during application of the compression layer. The end of the comfort foam layer may be temporarily secured with tape. NOTE: If the toes are going to be included, apply compression layer after the toe application (see “Application for Toes”).

Step 7: With the foot in a 90° dorsiflexed position, start the application with a circular winding at the base of the toes, beginning at the fifth metatarsal head.

Step 8: Complete two or three figures of eight around the ankle ensuring that the entire heel is covered.

Step 9: Proceed up the leg with 50% overlap ending the application approx. 7.5—10cm below the ending of the comfort foam layer. NOTE: To guarantee a stable total leg application, it is necessary that the upper leg comfort foam layer be in good contact with the lower leg comfort foam layer.

Step 10: As you end the application, apply light pressure and cut off the excess material.
3M™ Coban™ 2 Compression System
Application for the Leg and Foot (Cont.)

Application for Knee and Above the Knee

Layer 1: Comfort Foam Layer
- Apply this layer with the foam side against the skin, using just enough tension to conform to the shape of the leg with minimal overlap.
- Cover the skin with as thin a layer as possible with no gaps.
- When skin folds (aprons) are present, use pieces of comfort foam layer folded with foam side out to separate them.

Step 11: Reposition the patient to a standing position. A 5cm heel lift guarantees the required knee flexion.
Step 12: Select a 15cm or 20cm comfort foam layer, depending on the size of the limb.

Step 13: Proceed to wrap with a figure of eight technique to cover the knee with two circular windings. Make sure that no edges lie along the popliteal crease.
Step 14: Proceed to the top of the leg. Keep the overlaps as minimal as possible.
Step 15: Apply two full circular windings of comfort foam layer at the top of the leg to prevent edge roll. As you end the application, apply light pressure and cut off the excess material.

Layer 2: Compression Layer
- Apply even compression with at least two layers. Even compression is best achieved when the material is applied at full stretch.
- It is recommended that you hold the roll close to the limb throughout the application for controlled, even compression.
- If “bulges” are noted after the application, apply additional compression layer until the limb appears smooth.

Step 16: Start with two circular windings of the 15cm compression layer around the knee joint. Centre over the patella.
Step 17: Proceed distally and ensure there is sufficient contact between this layer and the lower leg compression layer.

Step 18: With figure of eight windings, enclose the knee and proceed up the leg ensuring at least two layers with a smooth application.
Step 19: Stop the compression layer application at top of leg. Apply light pressure and cut off the excess material.
Step 20: Mold the entire application to conform to the anatomy.
### Two Options for Application for Toes

**Option A: Individual Toe Wrapping**

- **Step A1:** Place a strip of comfort foam layer underneath each toe and secure it with circular windings beginning distally.

- **Step A2:** Using the 2.5cm compression layer roll, wrap each toe individually beginning distally. Apply layers at full stretch after the first circular winding with “relax-breaks” where, after each semi-circular winding, that piece is molded to the underlying layer. A rigid sleeve is then provided with comfortable pressure. Sequence: stretch—press and mold—relax.

- **Step A3:** When finishing the first toe, make a circular winding to provide an anchor for further toes bandaging.

- **Step A4:** Cut and restart for each toe.

- **Step A5:** Wrap remaining toes following steps A1, A2 and A4. The cohesive properties of the material allow fan folding to cover the proximal toe area without the need for multiple circular windings around the foot. **NOTE:** It is more comfortable to not bandage the fifth toe.

- **Step A6:** After toes have been wrapped, apply one circular winding around the foot to secure.

- **Step A7:** Mold the application to the anatomy of the foot.

- **Step A8:** After toe wrapping, continue with the compression layer for the leg (see Steps 7–10 from “Application for Below the Knee”).

**Option B: Toe Boot**

- **Step B1:** Fill each web space with pieces of double-folded comfort foam layer, foam side out and trimmed to shape.

- **Step B2:** With a 5cm wide comfort foam layer, make a circular turn without tension over the toes and the heel with the overlap over the 5th toe. Make a few slits to ease conformance over the toes.

- **Step B3:** Cover the open areas over and under the toes. Trim to fit and mold to conform.

- **Step B4:** Using a 5cm compression layer roll, without tension apply a circular winding from toes to heel. Cover the dorsal and plantar toe areas with compression layer applied at full stretch in a fan fold technique with semi-circular windings. Avoid circular windings around toes.

- **Step B5:** Mold the application to the anatomy of the forefoot.

- **Step B6:** After toe wrapping, continue with the compression layer for the leg (see Steps 7–10 from “Application for Below the Knee”).

### Bandage Removal

Dipping the scissor tips into cream allows comfortable and easy bandage removal.
Frequently Asked Questions

Q: What is the scientific explanation for why 3M™ Coban™ 2 Compression System works for lymphedema?

A: Coban™ 2 Compression Systems are engineered with *Intelligent Compression Dynamics* to create a conformable, inelastic sleeve that generates the working dynamics needed for effective venous and lymphatic return. The compression layer has been modified to be a short stretch bandage and is applied at full stretch to reduce application variability. Mayrovitz\(^6\) describes the effects of short stretch bandaging as providing the required resistance to support and distribute the dynamic working pressures created by functional, muscle activities to move interstitial fluids, soften fibrotic tissues and stimulate lymphatic contractility.

Q: Why don’t I need to pad and reshape the limbs when using Coban™ 2 Compression System for Lymphedema?

A: The ideal compression system has been defined as an inelastic sleeve with an *anatomical fit* around the patient’s limb which stays in place and provides a well tolerated pressure in rest\(^7\). Coban™ 2 Compression System materials are easily adapted to conform to most contours so that the inelastic sleeve provides the resistance to effectively support the muscle activities within the bandage. The end result is a thin system that enhances function and mobility. A controlled, multi-centre, prospective, open label study showed that Coban™ 2 Compression Systems (with twice weekly applications) were as effective as standard multi-layer short stretch bandages applied five times per week. Limb contours normalize with resolution of lymphedema.

Q: How can you be sure that there is equal pressure throughout and no pressure points are created due to not reshaping?

A: 3M™ Coban™ 2 Compression Layer is applied at full stretch with at least two layers. This results in a compression system that is thin and evenly applied. Studies\(^8\) have demonstrated that the inelastic sleeve created by Coban™ 2 Compression Systems was effective at reducing limb volume without extra padding and was comfortable to wear and well tolerated by patients who took part in the studies. There were no reported cases of skin damage on any of the 40 patients taking part in the study.

Q: What is the recommended method to apply Coban™ 2 Compression System?

A: 3M has designed new methods for the application of Coban™ 2 Compression System for lymphedema. Training workshops, videos and handouts are available from your local 3M representative.

Q: What evidence do we have regarding safety and efficacy of the Coban™ 2 Compression System for lymphedema?

A: Several studies\(^8\) have proven that lymphedema is effectively managed by Coban™ 2 Compression Systems with the added benefits of improving patients’ quality of life, function and mobility.
Q: How do 3MTM Coban™ 2 Compression Systems compare to the current reusable bandaging systems?

A: In a descriptive, qualitative study⁶, Coban™ 2 Compression Systems, with its conformable, thin, low profile was rated by patients to be more comfortable than their traditional bandages which can be restrictive and reduce function. Patients reported that the bandage was lighter, less obtrusive and improved their overall mobility throughout their treatment period.

Q: How can a product so thin possibly treat lymphedema?

A: Coban™ 2 Compression System materials have been proven⁷ to provide the required stiffness to distribute muscle contraction forces equally beneath the bandage, thus supporting the muscle dynamics to reduce edema. Additionally, the comfortable resting pressure and low profile construction provided improved function and mobility supporting the normal muscle pump.

Q: How does the cost of a disposable system compare to a reusable system?

A: Coban™ 2 Compression System required fewer number of intensive therapy treatments that off sets the increased cost for single use bandages. Coban™ 2 Compression System applied twice weekly was as effective as traditional short stretch bandages applied five times per week. This resulted in a significantly lower total cost for treatment.

Q: What pressures does the system deliver?

A: The original Coban™ 2 Compression System was designed to provide sub-bandage resting pressures of about 35–40mmHg on application at B1. This material is recommended for lower limb applications. 3M™ Coban™ 2 Lite Compression System provides 25% less sub-bandage pressures at application and this material is used for upper extremity applications. These pressures have been proven to be well tolerated⁸. Recent studies⁷,⁹ have shown that the stiffness of a system is more important than sub-bandage pressures in predicting the efficacy of a bandage. For arms, Damstra¹⁰ reported that low-pressure bandages are as effective as high-pressure bandages and with less discomfort.

Q: Why are there so many different SKU's?

A: 3M™ Coban™ 2 Comfort Foam Layer and 3M™ Coban™ 2 Compression Layer are provided separately (not in a kit) in a wide variety of sizes for clinician choice and convenience to meet the size and contour challenges of the patient with lymphedema.

Q: How long does Coban™ 2 Compression System stay on for?

A: The randomized, controlled, multi-centre, open labeled, prospective study⁶ demonstrated that Coban™ 2 Compression Systems with twice-weekly change were as effective and well tolerated as traditional short stretch bandage changes five times per week with a significant improvement of skin fibrosis and effective reduction of lymphorrhea.
Q: What if the legs are weeping? Will the foam layer absorb exudate?
A: The comfort foam layer will absorb exudate and "wick" usual skin moisture and evaporate it through the bandage. More frequent bandage changes may be required depending on drainage and as limb volume decreases.

Q: Can 3M™ Coban™ 2 Compression System adhere to other materials or to itself?
A: Patients wearing Coban™ 2 Compression System have reported that it can “stick” to itself and to sheets. This can be easily remedied by applying a thin cotton sleeve/liner over the system or thin, stretchable stockings to facilitate normal footwear application and removal.

Q: How long does Coban™ 2 Compression System stay on for?
A: In a controlled study, low slippage of the Coban™ 2 Compression Systems allowed effective treatment for up to 4 days. Frequency of change will be dependent on patient condition and volume reduction.

Q: When do I need to change the compression system? How will I know?
A: In a controlled study it was demonstrated that 2/week changing Coban™ 2 Compression System is sufficient. Coban™ 2 Compression System should be changed if it becomes loose fitting, and when it no longer conforms to the leg.

Q: Are lymphedema clinicians concerned about pressures?
A: Traditional lymphedema bandages incorporate multiple short stretch, inelastic bandages with a variety of padding materials to create a rigid bandage believed to provide graduated pressures according to Laplace’s Law. Though effective in reducing edema, these bandages create a number of problems for the patient. The overall bandages are stiff and bulky so that normal clothing and footwear is prohibited. Mobility is restricted, reducing flexibility and function required for the normal activities of daily living. Research has shown that Pascal’s Law better predicts the efficacy of a bandage. When an inelastic sleeve conforms to the limb and allows functional activities and movement, the intermittent contraction/relaxation forces are effective to move venous and lymphatic flow.

Q: What evidence do you have for benefits you are promising? Why should I change current practice?
A: Results of a randomized, multi-centre, prospective, open label study comparing Coban™ 2 Compression System to standard bandages showed equal volume reduction with twice weekly applications compared to traditional short stretch bandages applied 5 times per week. In addition, patients reported an improvement in their quality of life scores and mobility with the MYMOP (Measure Yourself Medical Outcome Profile). Patients rated their overall and limb mobility as good as their unbandaged limb. This system could, therefore, help patients exercise and mobilize more effectively as part of their intensive therapy.
Q: Can I teach my patients to apply it themselves?
A: 3M™ Coban™ 2 Compression System is used under the supervision of a healthcare provider. 3M has not studied nor provided self application methods.

Q: Can I use the compression system in conjunction with other bandages/padding material?
A: Several application techniques have been provided to help the clinician apply Coban™ 2 Compression System in such a way to create a thin, low profile, inelastic sleeve that conforms to the contours of the limb. This bandage will provide the correct support effective to move venous and lymphatic flow. It is recommended that Coban™ 2 Compression System be applied according to the application instructions by 3M.

Q: Is application easy to learn/teach?
A: Clinicians participating in the clinical studies to evaluate the safety and efficacy of Coban™ 2 Compression System for lymphedema reported that the methods are fast and easy once they become familiar and confident with the materials. The dominant observation of patients participating in the studies was that the application was much quicker, easier, less time consuming and less taxing physically and emotionally.

Q: What is the clinical evidence with this new compression system?
A: See Summary of Clinical Programs to support use of 3M™ Coban™ 2 Compression Systems for Lymphedema Bandaging.
References

1 Mei R. Fu, PhD, RN, ACNS-BC, Sheila H. Ridner, PhD, RN, ACNP, Jane Armer, PhD, RN, FAAN. American Journal of Nursing July 2009; 109(7): 48–54


8 Data on file at 3M, submitted for publication.
