The long and short of it: Understanding compression bandaging

What you need to know about long-stretch and short-stretch compression bandaging in patients with peripheral arterial disease

By Robyn Bjork, MPT, WCC, CWS, CLT-LANA

Margery Smith, age 82, arrives at your wound clinic for treatment of a shallow, painful ulcer on the lateral aspect of her right lower leg. On examination, you notice weeping and redness of both lower legs, 3+ pitting edema, several blisters, and considerable denudement of the periwound skin. She is wearing tennis shoes and her feet have relatively little edema, but her ankles are bulging over the edges of her shoes; both socks are wet. Stemmer's sign is negative. The wound on the right leg is draining copious amounts of clear fluid; it's dressed with an alginate, which is secured with conforming roll gauze. No signs or symptoms of infection are present.

Staff report Mrs. Smith recently had pneumonia and, at that time, started sleeping in her recliner at night due to difficulty breathing. She has chronic heart failure (HF) and usually has 1+ pitting edema of the legs, but had no skin problems before that. Acute HF has been ruled out. She also has Alzheimer's disease and wanders at night. She can't operate her recliner's electronic controls independently and fell twice trying to get out of the chair after the staff elevated the leg rest for her. Now they elevate her legs on a low stool and use a chair alarm.

In the past, Unna's boots were applied to both legs. But Mrs. Smith became agitated, and staff cut them off when a circumferential wound developed on the upper calf. Venous Doppler exam reveals an old deep vein thrombosis in the right leg. Ankle-brachial index (ABI) is 0.65 in the right leg and 0.7 in the left. Based on her ABI, a colleague informs the staff that compression therapy is contraindicated because Mrs. Smith has peripheral arterial disease (PAD). Meanwhile, her ulcer is getting worse and the family is unhappy with the situation.

How would you heal this wound? As you've no doubt noticed, wound healing is more complicated than just wound assessment and treatment. To select the most appropriate bandaging system, you must understand the concepts of extensibility, recoil, containment, and working and resting pressures. This article can help

you understand bandaging principles so you can confidently and effectively treat edema and heal wounds such as those of Mrs. Smith.

Extensibility: Long-stretch vs. short-stretch bandages

Extensibility is simply how much a bandage stretches.

- *Long-stretch* bandages contain elastic fibers that enable stretching to approximately 140% to 300% of their original length. Ace™ bandages are an example.
- *Short-stretch* bandages are woven with cotton fibers and stretch to about 30% to 60%. Examples include the Rosidal K® and Comprilan® bandages typically used in lymphedema management. A short-stretch system used in venous ulcer management is the Coban™ 2 layer compression system.

Some compression systems used in wound care have three or four layers. Although the total applied pressure of the bandaging system may be indicated in millimeters of mercury of force (mm Hg), individual layers may not be labeled as short-stretch or long-stretch. To test for yourself, simply stretch each layer to determine its type.

Working pressure and containment

Different bandaging systems have different effects on the venous and arterial systems and ultimately on edema. The effects relate to working and resting pressures, which I like to describe as containment and recoil. As a wound care clinician, you need to understand how short-stretch and long-stretch bandaging systems differ so you can make the right choices for your patients. (See *Comparing short-stretch and long-stretch bandages*.)

Roughly 60% to 80% of the body's total blood volume resides in the venous circulation, ranging from 60 to 150 mL. The 2012 International Lymphoedema Framework's position document for compression therapy states that blood pressure in the foot veins is 10 to 20 mm Hg in a supine position and 80 to 100 mm Hg in a standing position. During ambulation, when the calf muscle pump is functioning and vein valves are competent, blood pressure decreases to 30 mm Hg.

During walking or weight shifting, calf-muscle contraction is the primary means of returning blood to the heart through the veins. Pressure generated from the calf muscle can reach up to 300 mm Hg, propelling 60% of venous volume proximally with each contraction. Multilayered short-stretch bandages create an external force against calf-muscle contraction. They

Comparing short-stretch and long-stretch bandages

This chart describes some of the features of short-stretch and long-stretch bandages.

Short-stretch bandages	Long-stretch bandages
• Provide high working pressure and low resting pressure • Promote calf-muscle pump • Offer excellent edema containment • Improve peripheral venous and arterial blood flow	• Provide low working pressure and high resting pressure • Don't promote calf-muscle pump • Offer poor edema containment • May be hazardous for patients with peripheral arterial disease

cause generation of inward pressure because they don't allow calf muscles to bulge outward when they contract and shorten. This force compresses and pumps the veins, propelling blood toward the heart; graduated compression of bandages (more pressure at the ankle than calf) prevents backward blood regurgitation through incompetent veins. This is called *working pressure*. Thus, multilayered short-stretch bandaging systems cause high working pressure. Multilayered short-stretch bandages also act as a semirigid force to prevent expansion of edema. They offer excellent containment of all forms of edema.

In contrast, long-stretch bandages stretch as edema increases. They also provide little resistance to calf-muscle contraction. Therefore, they have low working pressure, don't promote the calf-muscle pump, and provide poor edema containment.

View: Calf-muscle pump video

Resting pressure and recoil

Resting pressure is the inward force a bandaging system exerts on a limb at rest, such as when the patient sleeps. It results from recoil of elastic fibers or the weave of cotton fibers in a bandage. Long-stretch bandages, which have elastic fibers, have high extensibility and recoil and therefore high resting pressure.

This sustained resting pressure poses a problem for patients with arterial disease. For example, at night, perfusion of an extremity decreases as the heart rate slows, blood pressure decreases, and the legs are elevated. Patients may tolerate a bandaging system with a long-stretch layer during the day but may experience increased pain at night. In contrast, short-stretch bandages exert low resting pressure due to their limited recoil and are safer for patients with concurrent PAD.

According to experts, short-stretch bandaging systems with up to 40 mm Hg of compression can be applied safely to patients with ABIs above 0.5 and absolute ankle systolic blood pressure higher than 60 mm Hg. One study found short-stretch compression increased arterial blood flow to the limb and periwound skin by 28% when 31 to 40 mm Hg of compression was applied and increased venous ejection fraction by 103%.

Making the right choice for Mrs. Smith

For Mrs. Smith, I'd start with a lightweight, padded, short-stretch bandaging system such as the Coban Lite 2 layer compression system, made up of a thin foam inner layer and an outer short-stretch Coban layer. (*Note:* Most Coban rolls are medium stretch unless labeled short stretch.) This will enable her to walk at night. Short-stretch bandages have low resting pressure, so they're safe to apply even though she has underlying PAD. The foam padding will protect her skin and avoid constriction and edging at the proximal aspect of the bandage. Also, the short-stretch system will recoil a bit as edema decreases, preventing the bandage from sliding down. When she walks, it will exert high working pressure to improve venous return.

Since Mrs. Smith's recovery from the acute bout of pneumonia, staff need to reestablish the pattern of her sleeping in bed instead of the recliner, to decrease her dependent edema. This will keep her bandages from becoming tighter and un-

comfortable at night. Once her venous and dependent edema improve, her skin ulcer will heal rapidly and the leg blisters and redness will resolve. Alginate or foam can still be used effectively under the bandaging system, and skin protectant can be applied to prevent further denudement.

Click here if you're concerned whether to apply compression to a patient with HF, like Mrs. Smith.

Click here to download the International Lymphoedema Framework's consensus document for compression therapy.

Selected references

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