

Post Operative Management of Lower Extremity Amputees Using Tubular Elastic Compression Bandaging

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Introduction

Edema is inevitable in a postoperative limb and is a matter of concern to all who are involved in the postoperative care and rehabilitation of amputees. Persistent edema, that is edema that fails to subside over a period of weeks following amputation surgery, delays the rehabilitation process including the fitting of the definitive prosthesis (1).

Several systems of compression bandaging have been investigated and reported in various medical journals. These include soft dressings, pneumatic pressure sleeves, stump shrinkers, semirigid dressings, and rigid dressings with or without a program of early ambulation (2,3,4). Of all of these systems, the most common one is the elastic wrap bandage (5). It is readily available inexpensive, comes in a range of sizes and is washable. In spite of its advantages, however, its users are also aware that it is difficult to apply, doesn't maintain continuous pressure, must be reapplied frequently, cannot be reapplied the same way each time, and loses its compressibility after a few washings.

Since the amount of external compression applied to the limbs seems to be a key factor in reducing edema, studies have been undertaken to define the "ideal" pressure. Some of the findings reported are as follows: 1. less than 5 to 10 mmHg of mercury is undersirable (6); 2. external pressure of 30 mmHg or greater decreased the venous flow rate of the leg (6); 3. external pressures above 25 to 30 mmHg, if sustained, may be potentially harmful (2); 4. pressures obtained from elastic wrap applied by skilled professionals ranged typically from 23 to 72 mmHg (5); 5. elastic compression to the lower limb markedly reduced the volume of the limb (5).

Development of a Product

Early in 1980 Knit-Rite, Inc.,¹ a manufacturer of prosthetic socks and stockinette tubing, initiated the development of a tubular elastic compression material that would be equal or superior to any compression bandage currently available on the market. Believing that such a product would have medical applications in the control of edema but uncertain of how it could

be made to achieve the desired pressures and other characteristics, they contacted the Physical Medicine Department, University of Kansas Medical Center, for recommendations. Out of this inquiry evolved an amputee study involving 41 amputees, 35 below knee (B.K.) and 6 above knee (A.K.) and resulted in a paper entitled "Pressure Applied by Stump Bandages: A Comparative Study," by G. Varghese et al.² This study compared the elastic wrap, the Knit-Rite tubular elastic bandage and stump shrinker, and another brand of tubular elastic bandage. It supported some beliefs and established others:

1. Elastic wrap was the most difficult to apply.
2. Pressures exerted by elastic wrap varied widely and the results were significantly different when applied by skilled and unskilled people.
3. Elastic wrap failed to sustain constant pressures over a prolonged period of time and had a tendency to loosen with usage.
4. Both tubular compression bandage products were more easily applied by patients and/or family members.
5. More consistent pressure over a prolonged period of usage could be obtained with tubular elastic bandages.
6. The Knit-Rite tubular compression bandage, when doubled, exerted a pressure which was in the "ideal" range, between 15 to 30 mmHg as measured by a solid state pressure transducer.

Actually, many changes in the product occurred during the course of this study.³ Finally the acceptable tubular compression bandage was made available as a 10 meter Compressogrip® roll in a range of widths and lengths and as a stump shrinker item in a range of widths and lengths. The stump shrinker item is individually packaged and labeled with care instructions.

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Size	Length	Fits Circumferences	Approximate Single Layer Pressure mmHg
			at 50% Stretch†
#2	18"-45 cm	6"-8"	8-12
	24"-60 cm		
#3	18"-45 cm	9"-12"	8-12
	24"-60 cm		
#4	18"-45 cm	12"-16"	8-12
	24"-60 cm		
#5	18"-45 cm	15"-20"	8-12
	24"-60 cm		
#6	30"-75 cm	15"-20"	8-12

†Double Layer Approximately Doubles Compression Figures.

Fig. 1 Sizing Chart for Tubular Elastic Stump Shrinkers

Field Testing

At the same time that the Kansas University Medical Center was conducting their research and continuing through the present time, Isle Orthotic-Prosthetic Services, of Kansas City, Missouri, was using the tubular compression bandage in the post-operative management of its referred amputee patients. Field testing was also conducted at a private prosthetics facility in the Kansas City area and at the V.A. Hospital.

These findings, while empirical do confirm the results of the scientific researchers. The earlier a program of tubular compression bandaging is begun post-operatively, the sooner swelling will subside and tissues can be properly supported and correctly molded to a shape acceptable for prosthetic fitting. The correct size of bandage must be selected and patients or responsible family members instructed concerning the proper method of applying the tubular compression bandage and maintaining a controlled, total-contact fit throughout the period of wear. The recommendation, with the permission of the managing physician, is to wear the bandage 24 hours per day, except for bathing or during periods of muscle spasm, cramping or persistent pain. At least 2 to 3 bandages need to be supplied to the patient to allow for laundering.

Selecting the Proper Size Bandage

Care needs to be taken in fitting to insure that the width selected achieves adequate compression without overstretching the material (Fig. 1) and that the length selected allows for a double layer (Fig. 2). Optimum compression occurs when the tubular compression bandage is stretched at least 50% but not more than 100% of the original width. For a B. K. amputee it is recommended that a circumference measurement be taken 2" below the medial tibial tubercle,

and for an A. K. amputee, 2" proximal to the distal end.

Example: The measured circumference is 11 inches. From the chart (Fig. 1) we see that Size #3 is the correct size. The sizes #2 through #5 are approximately 2" through 5" in flat width. Thus Size #3 is approximately 6" in circumference and would best accommodate measurements from 9" to 12" in circumference. If the differential between distal and proximal circumferences, as in extremely tapered A. K.'s, is greater than 5", then the next size larger bandage should be selected to avoid overstretching the material and to insure ease of application.

Applying the Bandage

On a below knee amputee, apply the first layer so that the material extends approximately 3" proximal to mid-patella. Slide the nylon ring (supplied with and surrounding the bandage) forward until firm distal pressure occurs, then reflect the second layer over the first to no more than 1/2" proximal to the superior border of the patella (Fig. 2). In this way, greater pressure is maintained distally than proximally. If necessary, excess material may be marked and cut off, folding inside the cut ends of the second layer to achieve a smooth edge; however, the cut edge may ravel. Different lengths are available to eliminate cutting as much as possible (Fig. 1).

Have the patient flex and extend the knee to check the security of the bandage. Then have the patient remove and re-apply the bandage several times until you are confident that the technique is mastered. Good follow-up is an important part of patient management. We recommend that the patient be re-scheduled at 2 to 3 week intervals to check the progress of the shrinkage. Remeasuring and recording all pertinent circumference and diameter readings can then be done. When measurements have stabilized

and no appreciable changes are noted from the last visit, casting for the definitive prosthesis can be initiated.

The same basic procedure can be followed with A. K. amputees, except that some A. K. amputees will require the addition of a modified garter belt or webbing suspension to minimize the tendency of the bandage to roll proximally.

Summary

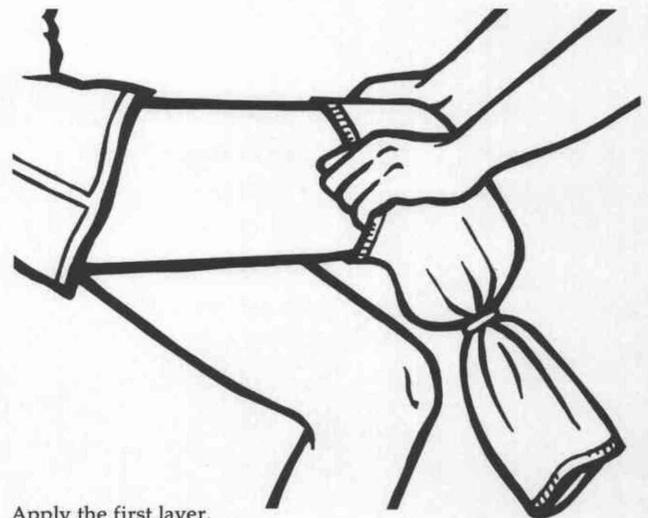
Our observations concur with recent research which suggests that the process of controlling and reducing edema is accelerated by using the Compressogrip® tubular compression bandage versus the conventional elastic wrap. Further, our experience indicates that the shaping of soft tissues is enhanced and that the post-operative period required to prepare the patient's residual limb for the definitive prosthesis is somewhat shortened when a tubular compression bandage is used. We project that patients managed in this fashion will have fewer post-fitting problems that are related to additional shrinkage occurring in the first few weeks of prosthetic wear and that the incidence and/or severity of phantom sensation will be reduced as a result of the controlled compression of the Compressogrip® tubular compression bandage.

Notes

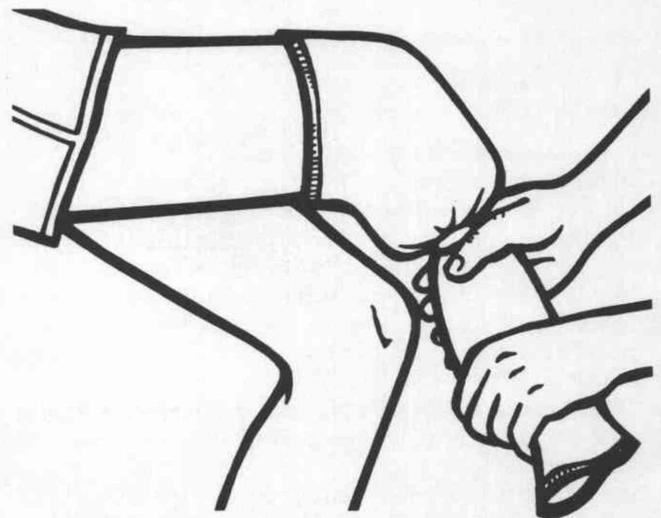
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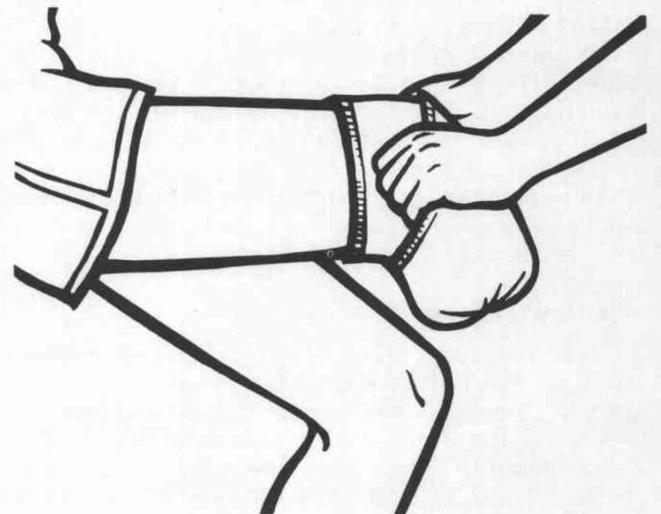
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3. Puddifoot, P.C.; Weaver, P.C.; Marshall, S., "A Method of Supportive Bandaging for Amputation Stumps", *Br. J. Surg.*, 60: 729-731. 1973.
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5. Manella, K.J., "Comparing the Effectiveness of Elastic Bandages and Stump Socks for Lower Extremity Amputees", *Physical Therapy*, 61, March 1981.
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Apply the first layer.



Position the ring snugly.



Apply the second layer to a point 2" to 3" below the first.

Fig. 2 Application Technique