Elastic Knee Control

by Robert E. Fannin, C.O.

Introduction

Most knee orthoses are designed to control medial and lateral instability, recurvatum, and some knee flexion weakness. One major problem that arises in knee braces is keeping them in a functional position. A waist belt with a suspension strap or an extension to the shoe can be added to help control this problem. If a severe knee problem is present, a knee brace alone is usually not sufficient, and an above-knee orthosis should be used.

A knee support that does not present the problem of staying up on most patients is the elastic type with reinforcements. A mistake made by most practitioners when designing this type of support is that they make the elastic too short and the reinforcements too soft and flexible. Another serious problem is that most elastic knee supports are taken off a shelf or out of a box and put on the patient; in nine cases out of ten a good fit is impossible because an exactly fitting support is not available, and what is at hand is considered to be "close enough." For a correctly fitting elastic knee support, the patient should be measured and then the elastic support made to fit those measurements if a stock model does not fit.

Many types of reinforcements are used with elastic knee supports. These may be plastic or metal stays, spiral stays, or jointed uprights. Most of the time, the stays are used to prevent the elastic from wrinkling or rolling down, and actually give very little support. The jointed uprights are designed to give good medio-lateral support, but they do little to restrict flexion extension motion. Most commercially available elastic knee supports with medio-lateral jointed uprights made today

Anterior View
Figure 1(A)

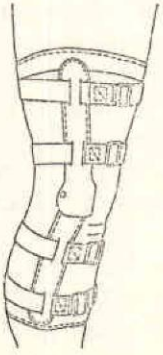
are too short and the uprights are too short and malleable. This would be a problem if a patient were going to wear this support while participating in sports. Two views of a properly designed elastic knee support are shown in Fig. 1(A) and (B).

Fabrication Procedures

An illustrated procedure, from measurement of the patient through application of the orthosis to the patient, follows.

Tracing and Measurement

1. Make a tracing of the affected knee in the same manner as for an above-knee orthosis except that the foot need not be included.



Lateral View
Figure 1(B)

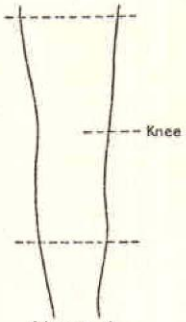


Figure 2

2. Place marks on the patient's leg at mid-thigh, ¾ inch superior to the medial tibial plateau, and at mid-calf. The upper and lower marks should be equidistant from the mark on the knee. Measure, and record length on tracing.

3. Take circumference measurements at (1) mid-thigh, (2) midway between mid-thigh and knee, (3) at the knee, (4) at the tibial protuberance, (5) at the widest part of the calf, and (6) just below the calf for the distal measurement. Record circumferences on the tracing.

Note: Record measurements on Order Chart, and order elastic. When it is received, start fabrication. (A typical order chart is shown here.)

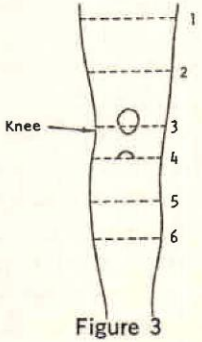
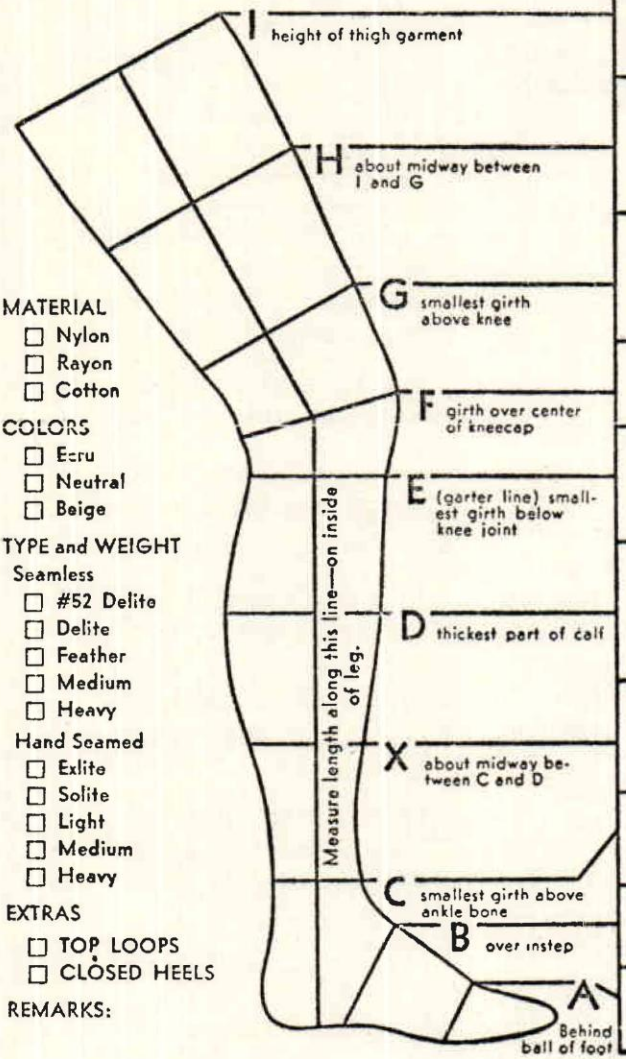


Figure 3

In taking measurements, check dimension at each point indicated on diagram, measuring not only circumference, but also length from base line to point at which each circumference is taken. On length measurements up to and including F, the floor is base line; on length measurements above F, center of knee-cap (point F) is base line. All length measurements are taken along INSIDE OF LEG; make sure that measurements for length and circumference are taken at exactly the same point. Accurate length is as important as accurate circumference.

MARK ALL DETAILS ON THIS SHEET Check type of garment desired. Weight; Color. Check Right or Left leg. Then measure leg at points indicated on diagram, taking measurements of both circumference and length.

MAKE YOUR MEASUREMENTS ACCURATE
We allow for normal compression
If extra compression is required note under "Remarks"



	CIRCUMFERENCE		
	RIGHT	LEFT	LENGTHS
I	I	I	F to I
H	H	H	F to H
G	G	G	F to G
F	F	F	Floor to F
E	E	E	Floor to E
D	D	D	Floor to D
X	X	X	Floor to X
C	C	C	Floor to C
B	B	B	A to B
A	A	A	

MATERIAL
- ☐ Nylon
- ☐ Rayon
- ☐ Cotton

COLORS
- ☐ Ecru
- ☐ Neutral
- ☐ Beige

TYPE and WEIGHT

Seamless
- ☐ #52 Delite
- ☐ Delite
- ☐ Feather
- ☐ Medium
- ☐ Heavy

Hand Seamed
- ☐ Exlite
- ☐ Solite
- ☐ Light
- ☐ Medium
- ☐ Heavy

EXTRAS
- ☐ TOP LOOPS
- ☐ CLOSED HEELS

REMARKS:

Ship to:..... Order No.....

Address..... Date.....

Figure 4

Fabrication of Jointed Uprights

4. Make a pattern of the upper and lower parts of the knee joints. (A permanent pattern of this joint may be kept on file for use when needed.) The total length of the uprights should be 1 inch less than the length of the elastic. They should be 1⅛ inches wide at the joint, tapering to 11/16 inch at the end.

Mark location of joint centers.

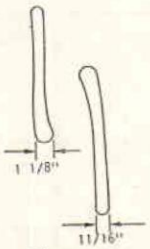


Figure 5

5. Cement the patterns to duraluminum sheeting of proper gauge, or trace around them if they are permanent patterns. For the average patient, the duraluminum should be of .100 thickness; use .125 for a large or very strong patient.

Cut out; finish edges.

6. Center-punch and drill ¼-inch holes for joint centers.

7. Rivet the joints together, using large-headed rivets. The heads should be as thin and smooth as possible. Put the heads of the rivets on the outside of the joint. Put thin brass or nylon washers between the two parts of the joint and under the rivet head.

Peen over the rivet at the inside of the joint to make it smooth as possible.

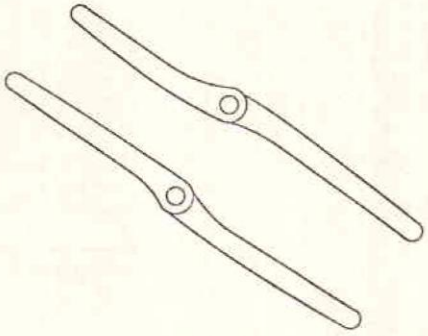


Figure 6

8. Shape the uprights to the tracing. Unlike those for a regular leg brace, these uprights should be fitted accurately to the tracing, allowing only for bony prominences, such as the head of the fibula.

9. Clean the parts and finish the metal (polish, sandblast, wirebrush, etc.).

Fabricating the Elastic Knee Control

10. Fold the elastic lengthwise, anterior to posterior, exposing one side.

11. Locate the center from top to bottom, and mark as shown in Fig. 7.

12. Center the uprights and joint on this center-mark and, using a pencil, draw lightly around both


Figure 7

Figure 8

ends of the upright to about 1½ inches above and below the joint center. (Fig. 8)

13. Repeat Step 12 on the opposite side of the elastic for the other joint. Then transfer the markings to the inside of the elastic to establish location of the padding.

The line can be transferred by inserting a sharp pencil or other sharp-pointed instrument through the elastic at intervals along the line, and marking the points where the instrument emerges on the inside. Then these points can be connected by a pencil line on the inside.

14. Using 3- or 4-ounce elk leather, cut a cover for the above-knee part of the upright, with a flap to cover the joint, as shown in the sketch. Allow enough extra width to sew a double row of stitching around the upright (see pattern shown in Fig. 9).

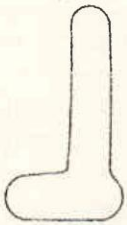


Figure 9

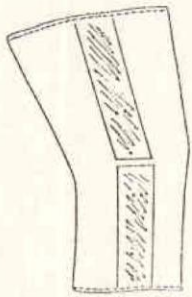


Figure 10

15. Make a leather cover for the below-knee part of the upright, again allowing enough leather to sew a double row of stitching around the upright.

16. Cut four pieces of white wool felt ⅛ inch thick. Two of these are to pad the above-knee uprights and two, the below-knee portions. Allow enough width to run a double row of stitching around the uprights.

Note: The felt serves two purposes. It reinforces the stitching, and also protects the patient's leg against pressure from the metal joints.

17. Apply rubber cement to one side of the felt pieces, and allow it to dry.

18. Turn the elastic inside out. Apply a coat of rubber cement to the areas marked in Step 13. When the cement is dry, stick the felt strips to the elastic. Then turn the elastic right-side out.

19. Apply a ¼-inch line of rubber cement around the joint markings on the elastic made in Step 12.

20. Apply rubber cement to a strip about ¼ inch wide around the edges of the unfinished side of the leather joint covers.

Figure 11

21. Hold the above-knee portion of the joint cover over the joint.

Fold the joint flap under as shown in Fig. 11. Stick the joint flap together and fasten it with a speedy rivet. Repeat for second upright.

22. When the cement is dry, stick the joint covers to the elastic with the joints in position.

23. Run two rows of stitching around the uprights. Sew as closely as possible to the uprights, for a snug fit.

Trim off excess leather if necessary. Also trim off excess length of white felt padding.

Note: No rivets are used to hold the joints in place. This permits joints to be removed so that the elastic can be laundered. Also, the patient can have two elastics and one pair of joints, permitting a change without duplicating the joints.

Elastic Straps

For greater stability, four 1-inch elastic straps can be added: two above-knee (one at the top of the upright and the other just above the knee) and two below the knee (one just below and the other at the bottom of the upright). Following is the procedure required:

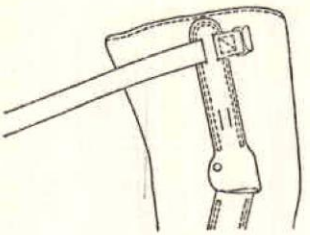


Figure 12

24. Cut four straps of heavy 1-inch elastic. The required length is the circumference at the level of each strap plus 5 inches.

25. Fold over the end of the strap twice, approximately 1 inch each time, with a buckle hook in place. Then stitch.

Note: Strap stays may be fabricated of lengths of plastic tubing cut to size.

26. Put a tip on the other end of each strap. The tips may be made of metal, plastic, or wax.

27. Cut slots in the upright covers at the level of each strap. The slots should be wide enough to accommodate a 1-inch strap. They should be paired at each upright, as shown in Step 28.

28. Insert finished straps in slots. Start from lateral anterior to posterior, passing around the back of the leg, through the medial posterior to the anterior, over the front of the leg, to the buckle and hook.

Apply support to patient.

The completed elastic knee control is shown in Fig. 13.

Figure 13