

TECHNICAL NOTE:

The "Overlap" Bisectonal Forming Technique in Orthotics

David C. Showers, C.P.O.

INTRODUCTION

For over 10 years, vacuum forming sheet plastics has been an accepted routine fabricating process, especially in orthotics. Originally, vacuum forming sheet plastic was accomplished by placing the plastic between metal holding frames and then pulling the hot sheet of plastic over the modified positive plaster model.

Although this forming process is still used by many practitioners and technicians in prosthetics, drape vacuum forming has become the more popular technique used in orthotics today.

The advantages to drape molding vs. the frame molding method are:

1. The orthotist is not restricted to the certain size of mold which must fit within a metal frame.
2. Maintaining uniform thickness in the plastic during the forming process is enhanced.
3. There is minimal chance for error once the process is mastered.

These are just a few of the advantages to this simple forming process. However, limitations may still exist in many facilities; not from the drape molding process itself, but from the lack of an adequate size oven. This article will discuss an alternate

way of vacuum forming sheet plastics utilizing the drape molding method for those facilities which do not have an oven large enough to house the size of plastic sheet needed to cover an adult size knee-ankle-foot-plaster positive mold.

STEPS IN THE FORMING PROCESS*

- Measure the proximal and distal sections of the positive plaster mold to determine the appropriate sizes of the plastic sheets (mark $\frac{1}{2}$ " superior and $\frac{1}{2}$ " inferior from the knee center) (Figure 1).
- Cut plastic to the size required and place these sheets on separate shelves in the oven. Note: A multi-shelf oven is necessary for this technique (Figure 2).
- When the plastic has reached its molding state, remove the distal section first. Place the hot plastic sheet over the plaster positive mold by draping, as is commonly done in forming for an ankle-foot orthosis (Figures 3 and 4).
- Quickly remove the second (proximal)

*At least two experienced staff are required for successful completion of this technique. Familiarity with the standard drape molding technique is recommended.

section and place this sheet on the proximal end of the positive mold and "overlap" the distal section by approximately one inch (Figure 5 and Figure 2).

- Working swiftly, seal the plastic around the model as if it were one complete section and evacuate the air as is commonly done in the vacuum forming process (Figure 6).

- Trim excess plastic and allow vacuum machine to run until the plastic has adequately cured (Figure 7).

- Remove the overlap section of plastic around the knee (Figures 8A, 8B, and 8C).

- The model is now ready for attachment of the knee joints to the thigh and calf sections (Figures 9A and 9B).

ADVANTAGES

- The orthotist has greater control during the forming process with two smaller sheets of plastic rather than one large sheet.

- Different types of plastic may be used for each section, i.e. a polypropylene distal section with a polyethylene proximal section.

- Different thicknesses of plastic may be used simultaneously during the forming process.

- Negative models do not have to be cut in sections.

- Saves time in fabrication, and the practitioner maintains control of the entire process.

DISADVANTAGES

- Process requires more technical staff during the forming.

- An oven with more than one shelf is needed.

- Greater skill is required due to the limited working time during the forming, since the distal section is placed on the positive mold approximately 20 seconds before the proximal section.

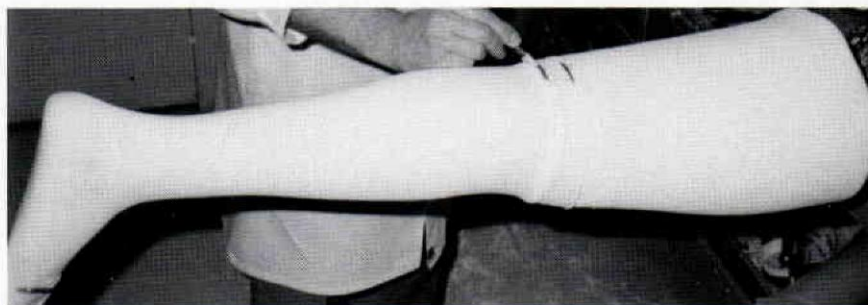


Figure 1. Marks on the positive model eliminate guessing the location of the overlap area during the forming process.

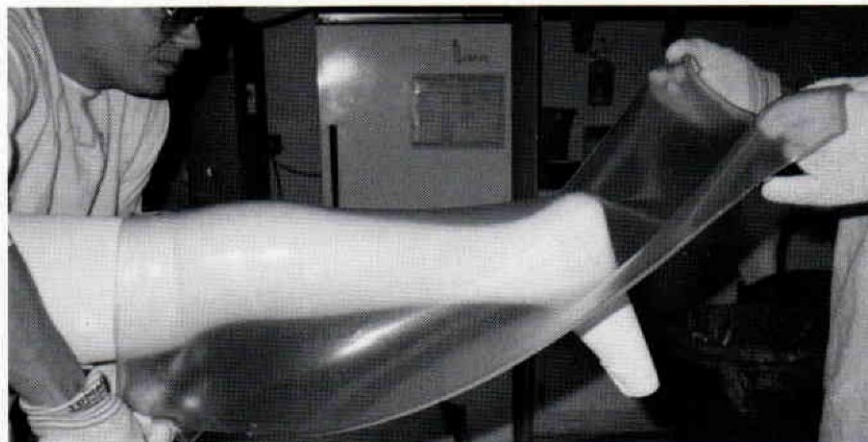


Figure 2. Two staff members place the distal section on the positive model to insure accuracy.

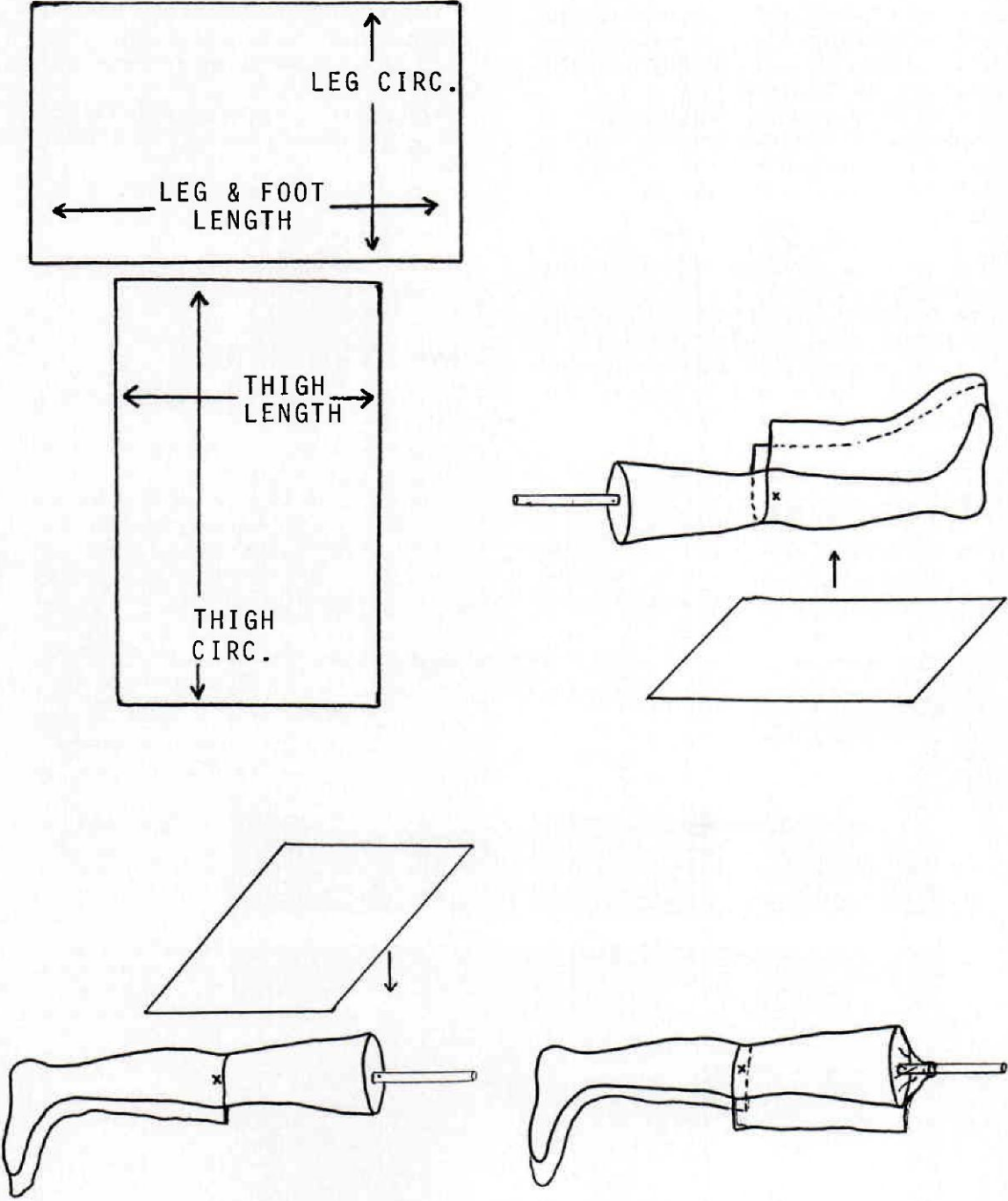


Illustration A. The procedure for overlap is shown.



Figure 3. While one staff member seals the hot plastic, the other individual removes the proximal section from the oven.



Figure 4. When the proximal section is removed from the oven both staff members work together and place the proximal section on the positive model with the full length going around the thigh.



Figure 5. Continue to check for areas not sealed.

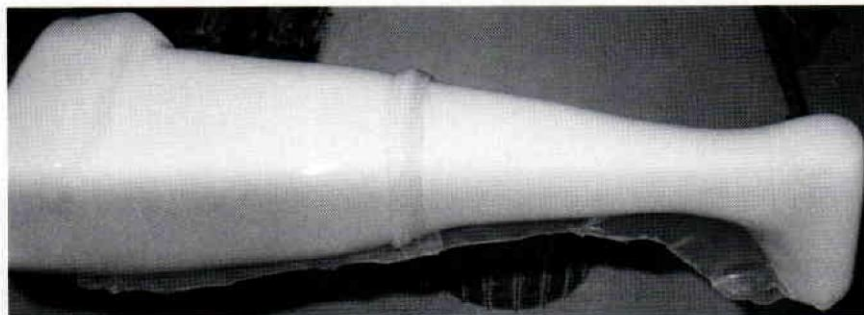


Figure 6. Forming is complete.



Figure 7-A. Overlap area is located superior to the knee axis.

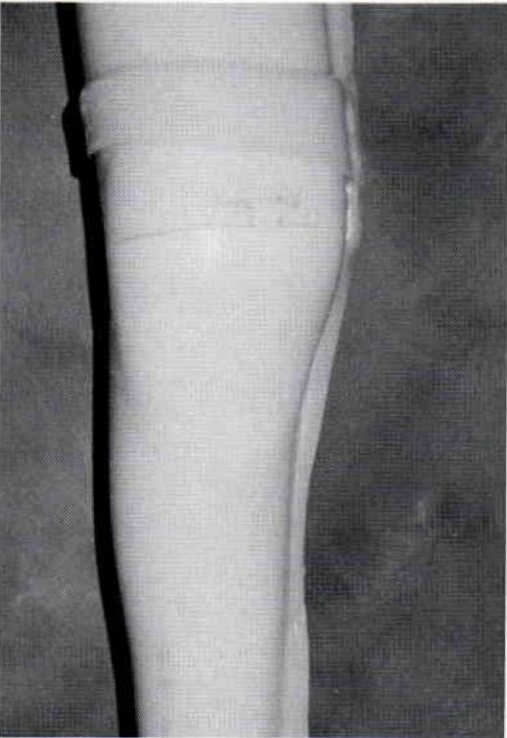


Figure 7-B. Form of knee ankle foot orthosis for a patient with genu valgum.

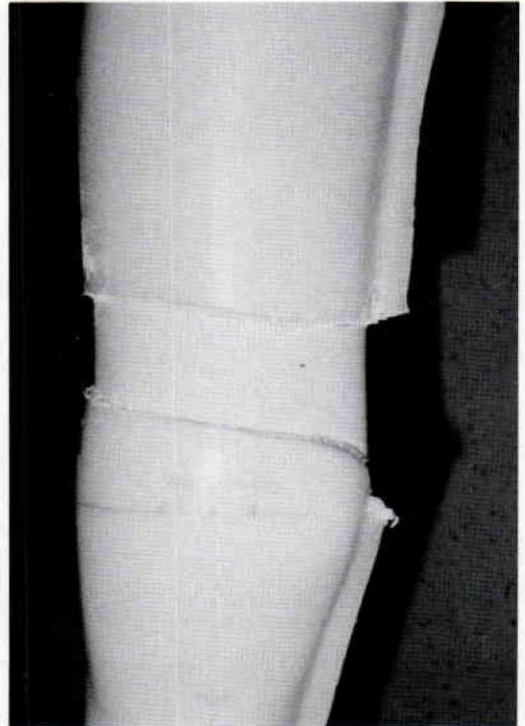


Figure 7-C. The knee ankle foot orthosis form with overlap removed from the distal thigh. Increased surface area is maintained at the medial tibial area for support of the genu valgus deformity for a patient afflicted with arthritis.

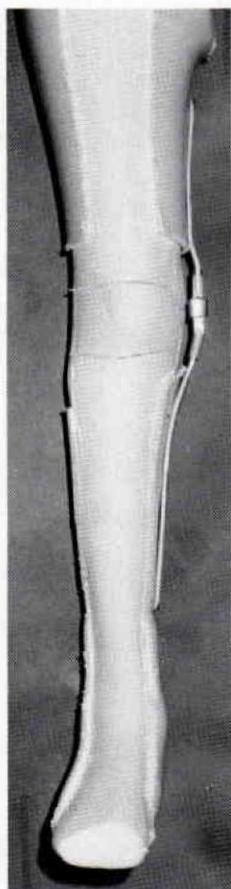


Figure 8-A. Anterior view of the knee ankle foot orthosis showing medial knee joint only.



Figure 8-B. Medial view of the knee ankle foot orthosis with knee joint in proper alignment in antero-posterior plane for a patient with paraparesis.

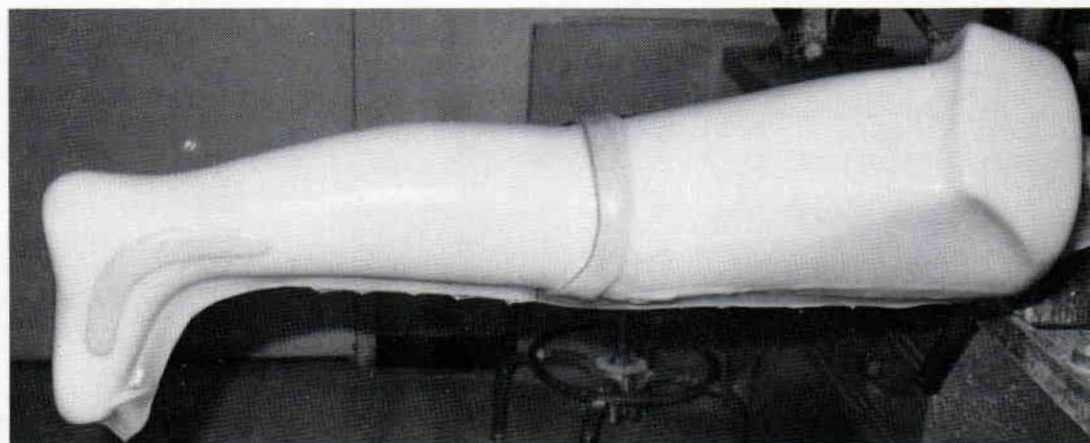


Figure 9. A left knee ankle foot orthosis formed for a patient with an unstable femoral fracture and a hemiparesis due to a right cerebral vascular accident.

CONCLUSION

The Orthotics-Prosthetics division of the Physical Medicine and Rehabilitation Department at the Hospital of the University of Pennsylvania has utilized this fabrication process for its knee-ankle-foot orthosis projects for more than four years. There have been minimal failures since the implementation of this technique. Successful forming has routinely been accomplished on such projects as forming over single and double bar knee joints, over single and double mechanical articulated ankle joints, over carbon fiber composite inserts (See Figure 10), and over other reinforcements such as requested by the practitioner. It is recommended by the author that the single section forming process be the practition-

ers' first choice. But for those facilities which meet the criteria previously mentioned, the "Overlap" bisecting forming technique is offered as an extension to an already accepted vacuum forming process.

AUTHOR

David C. Showers, C.P.O., Director, Orthotics and Prosthetics Division, Department of Physical Medicine and Rehabilitation of the Hospital of the University of Pennsylvania. Lecturer, University of Pennsylvania Medical School, Physical Medicine Rehabilitation.

ACKNOWLEDGMENTS

I would like to thank Martha Strunk, C.P., Staff Prosthetist-Orthotist, Orthotic-Prosthetic Division, Physical Medicine and Rehabilitation, Hospital of the University of Pennsylvania, for her assistance in preparing the sketches.

I would also like to thank Laird David, R.T.(O.P.) and Edward Sharer, R.T.(P.), for their assistance in the preparation of the illustrations.