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Technical Note: Application of a Prosthetic Sheath in Orthosis Fabrication

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INTRODUCTION

During the early 1970's, vacuum forming high temperature sheet plastics was introduced and subsequently promoted as an effective fabrication process for orthotics and prosthetics. Forming the hot plastic over a modified positive mold is not a problem in most cases, when vacuum is utilized to complete the process. Nor is forming the hot plastic over small sections of soft plastic pads, such as plastizote, a difficult task.

However, when attempting to vacuum form the rigid plastic over a continuous soft interface (Aliplast 4E,® plastizote) the problem of total contact and adherence of the rigid plastic to the soft interface may arise. This article will suggest an alternative technique utilizing the Nysert Sleeve® in the vacuum forming process placing the sleeve between the rigid sheet plastic and the closed cell polyethylene foam interface (Figure 1).

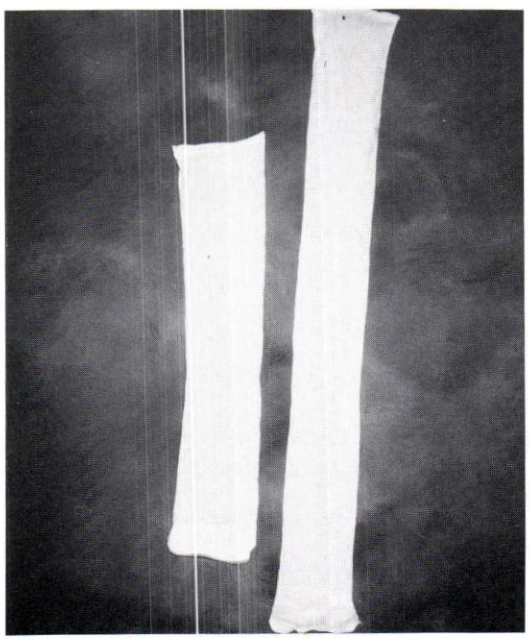

Figure 1. Below knee and above knee Nysert® Sleeve.

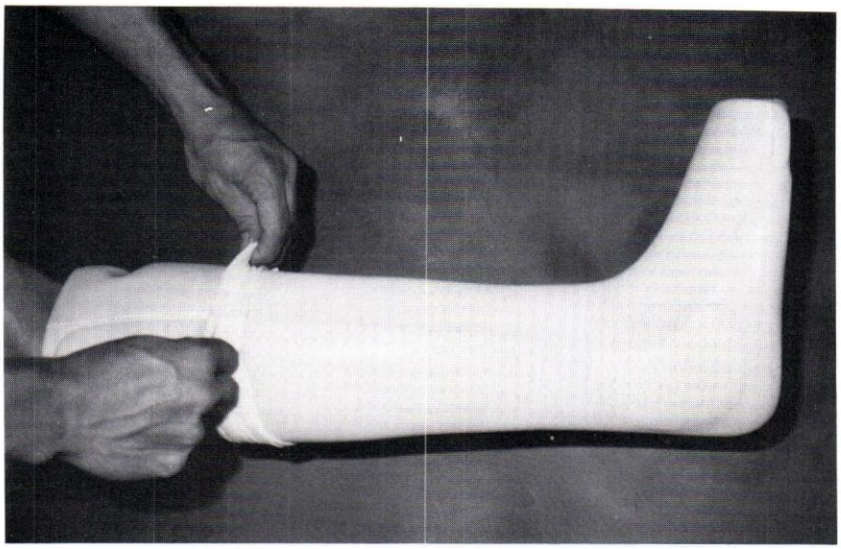

Figure 2. (left) First, the below knee sleeve aids in holding posterior section on the positive model. A second sleeve aids in the vacuum-forming process for the anterior Aliplast® liner.

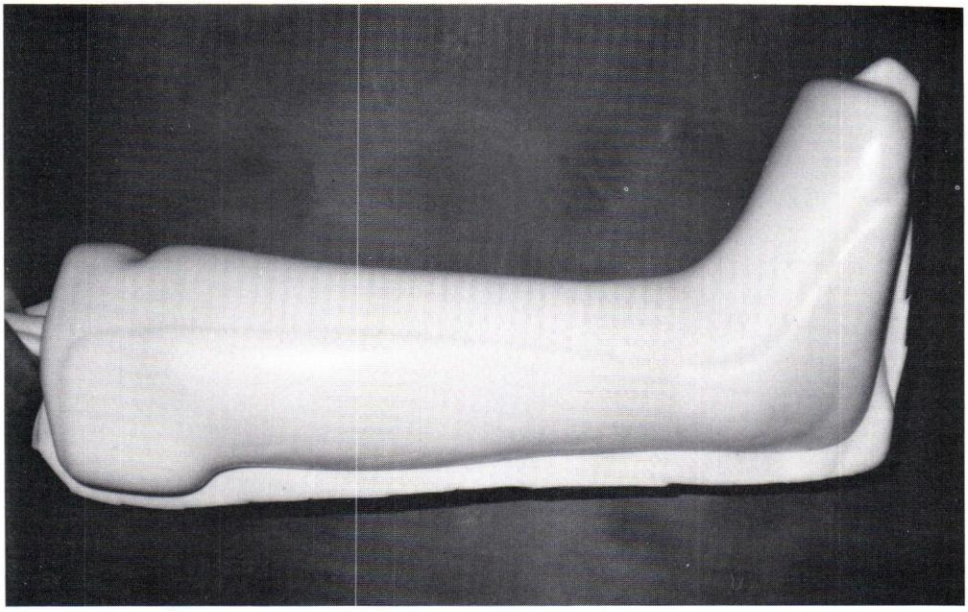

Figure 3. Vacuum is used to complete forming process.

PROCEDURE

The following are recommended steps in fabrication of a PTB non-articulated total contact fracture orthosis using the Nysert Sleeve®:

- Prepare model for posterior polypropylene vacuum forming (note: it will be assumed by the reader that all processes described in the article refer to the use of the hand drape molding process).
- After the plastic has cured adequately, the posterior section is removed for the finishing process and placed back on the positive model when completed.
- Place one Nysert Sleeve® over the posterior polypropylene section on the model (Figure 2).

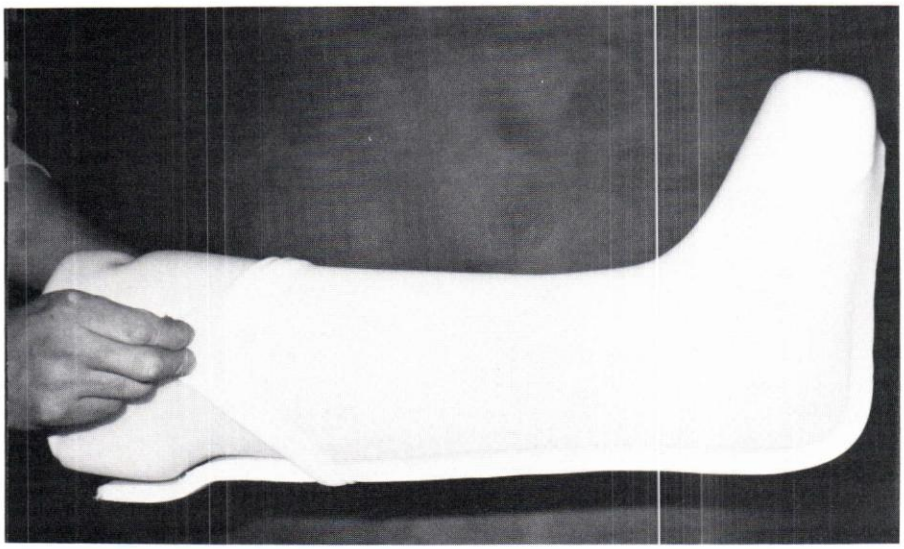

Figure 4. Placing the second sleeve should be accomplished by applying considerable tension so the anterior liner and posterior strips are securely held in place.

- Form the anterior Aliplast® 4E, or similar material, liner over the model (vacuum is optional). A $^{3}/_{16}$" or $^{1}/_{4}$" thickness is recommended for the liner (Figure 3).
- Remove the Aliplast® liner and trim excess material, according to the practitioner's criteria.
- Place the anterior liner back on the model (note: do not glue the foam liner on to the model[1]).
- Simultaneously place a second Nysert Sleeve® over the Aliplast® liner and posterior protective strips (Figure 4). Plastizote or Aliplast scraps may be used as protective strips.
- Vacuum form either polypropylene or polyethylene over the liner (note: plastic should be heated two minutes longer than normal to assure permanent adherances between the soft interface and the polypropylene or polyethylene) (Figure 5).
- After the anterior form has adequately cured, the anterior section is removed from the model. Excess sheath mate-

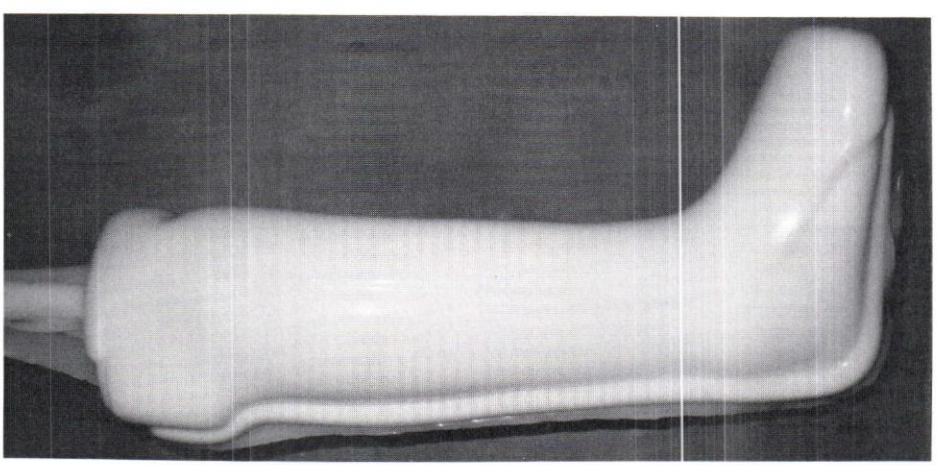

Figure 5. The process is completed without fear of air pockets between the liner and rigid plastic.

rial is removed along the edge of the liner (Figure 6), and the anterior section is finished by smoothing the plastic edges, thereby completing the process.

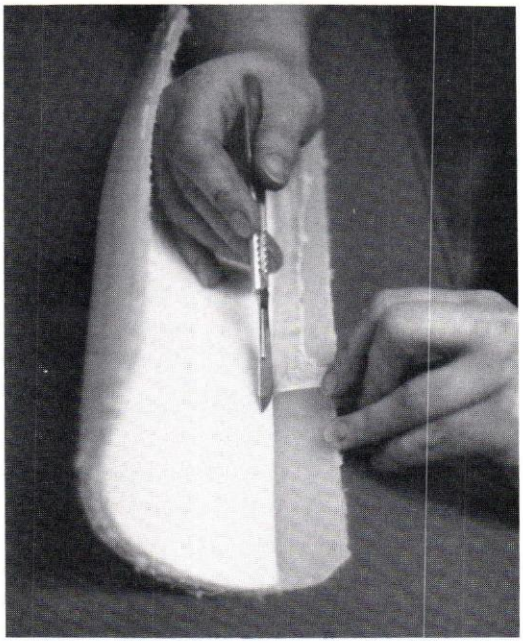

Figure 6. An extremely sharp knife is required to remove excess material neatly.

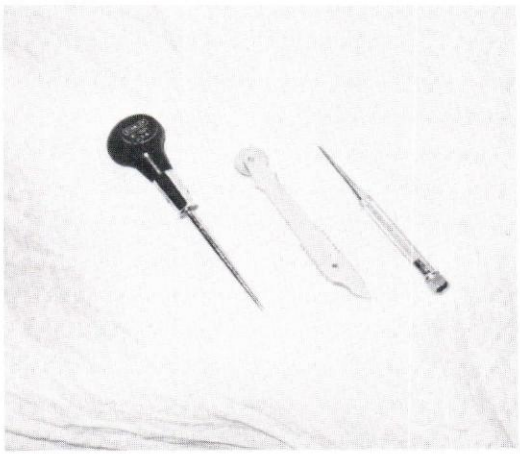

Figure 7. Awls, scribes, and rollers do not have to be used in this process.

ADVANTAGES

- Holes do not have to be punched through the closed cell polyethylene interface to allow for air flow.[1] (Figure 7).
- The soft interface does not have to be glued to the model.[2]
- Potential air pockets are eliminated between the soft interface and rigid plastic.
- Time is saved in fabrication.
- Cosmesis and quality are improved.

DISADVANTAGES

- There is a slight increase in cost due to the purchase of the sleeves.
- Vacuum must be used during the forming process.

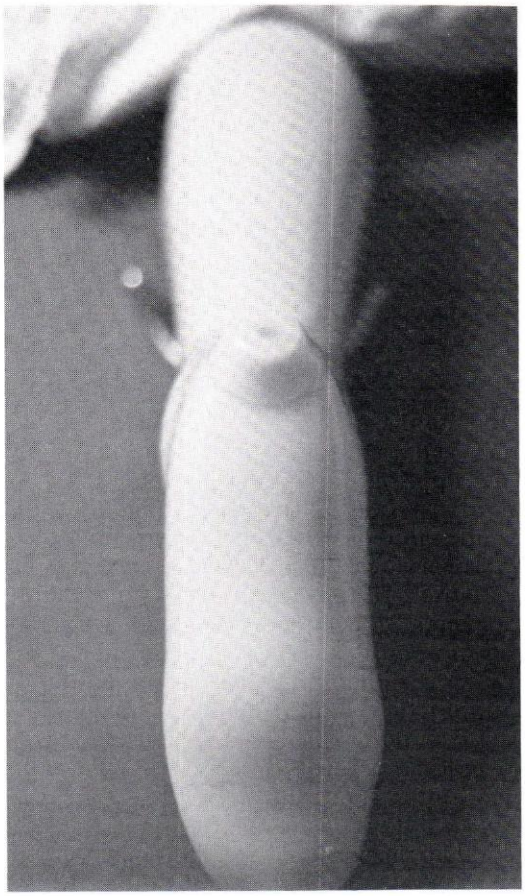

Figure 8. BK Nysert® sleeves may be used in fabricating the "lively orthosis." Finishing the edges has not been a problem.

OTHER APPLICATIONS

The Hospital of the University of Pennsylvania (HUP) Orthotics/Prosthetics lab uses this technique in the fabrication process of other projects such as the "lively orthosis" (Figure 8), full liners for knee orthoses, KAFO's with full or partial liners, upper extremity EWHO's, WHO's which require full liners (Figure 9), and occasionally for the plastic thigh sections of below knee prostheses with knee joints. Virtually any project which requires a soft closed cell foam (e.g. Aliplast®) interface can benefit by utilizing this technique, especially when the surface area to be covered is increased. The greater the surface area, the more advantageous is this technique.

An exception to this practice may be in the fabrication of the plastic TLSO. We have limited experience in applying this procedure at the present time, since our plastic TLSO's are fabricated utilizing Surlyn® plastic.

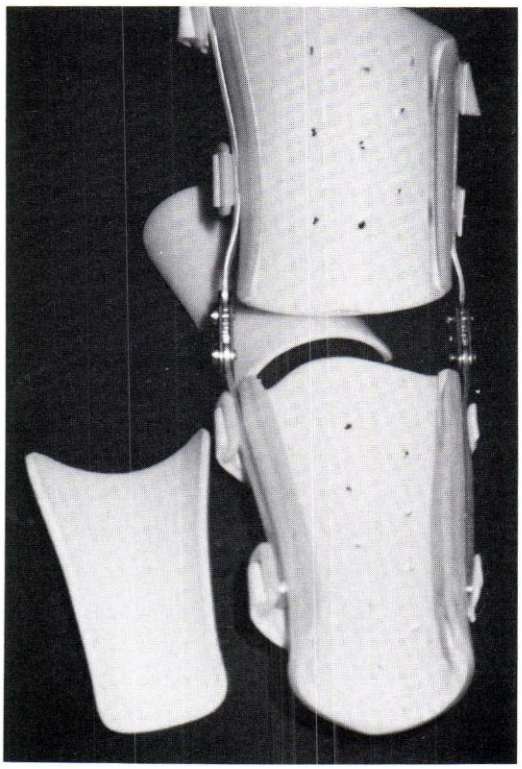

Figure 9. An elbow fracture orthosis with a full anterior and posterior liner.

CONCLUSION

The HUP Orthotics/Prosthetics lab has used this technique for five years. We feel that cosmesis has been improved and errors in the forming process have almost been eliminated. Occasionally the rigid plastic does not adhere to the Aliplast® foam; however, this happens when the rigid plastic is not heated for the proper length of time. For those practitioners and technicians who work extensively with sheet plastic and soft interface combinations, this technique is recommended as an effective way to improve product quality and patient care.

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[2]Wilson, A. Bennett, Jr., David Condie, Charles Pritham, C.P.O., and Melvin Stills, C.O., Lower Limb Orthotics, Rehabilitation Engineering Center, Philadelphia, Philadelphia.