

# Technical Note: The Use of Low Heat Thermoplastics in Vacuumforming

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## INTRODUCTION

During the past few years, many new plastics have been introduced to the rehabilitation field, many of which have proven applications for the field of orthotics and prosthetics. The majority of interest by professionals in our fields has been directed first toward the types of rigid high temperature plastics, such as polypropylene, various types of co-polymers, ortholene, Surlyn,<sup>®</sup> etc., used in definitive prescription items such as ankle foot and knee ankle foot orthoses, TLSO's, prosthetic check sockets, and similar devices. A lesser occasional interest has been directed towards a class of low temperature plastics used generally in temporary prescription items, such as those in the Orthoplast<sup>®</sup> and Warm and Form<sup>®</sup> categories.

The types of low temperature plastics in this second category have another application that has been used to some extent by our fellow professionals in occupational

therapy. Many of these plastics lend themselves to low heat forming in the adaptation of many items used by the severely handicapped in an attempt to restore as many of the independent living skills to the patient as possible. This technique has limitations, and the end results are sometimes affected by a lack of technology and equipment available in patient care environments.

## DISCUSSION

Due to our in-house facility caseload, we were faced with the problem of designing and fabricating many orthotic and prosthetic devices in the laboratory without devoting a disproportionate amount of time to each item. To solve this problem, it was discovered that by using a modified vacuum forming technique and low temperature plastics, there existed a quick, efficient method of adapting such devices as

Figure 1. (left) Forming table, metal frame, Polyform.<sup>®</sup>

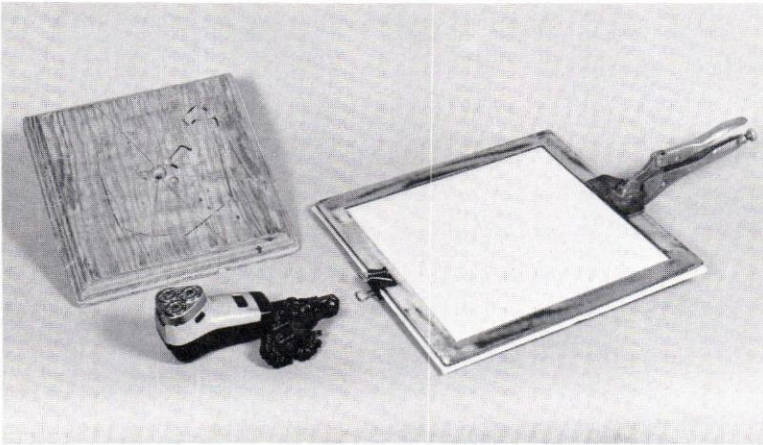


Figure 2. (right) Preparation of razor and vacuum table.



electric and manual razors, large handles on self care items, electric toothbrushes, blow dryers, larger kitchen utensils, extended hand reachers, writing devices, and molds of the hand and fingers.

## METHOD

We currently use the Orthomedics\* vacuum forming system, with the only necessary change being a specially constructed frame and worktable that attaches to the system. These can be specially ordered or fabricated in any laboratory. A much smaller size table is easier to work with and is more economical, especially with the cost of these plastics being much higher per square foot than those of the high

temperature plastics commonly used in orthotic and prosthetic facilities.

For instructional purposes only, the example for this article will be an electric razor, and the plastic used will be 1/8 inch non-perforated Polyform, A-292-1,<sup>®</sup> available from Rolyan. Many other types of low temperature plastics are also adaptable to this method (Figure 1).

The item to be formed must be prepared by removing any parts that can be filled in with plastic, such as the blade slots, switches, or lights on this electric razor. If open holes lead to internal working parts, cover them with masking tape (tape can be removed after molding). Next you must remove all electrical cords and attachments, and make sure the item is clean. Support the item on the forming table with a small block of wood, felt, or other material that will ensure that most of the item to

\*Orthomedics, Inc., 2950 E. Imperial Highway, Brea, California 92621.



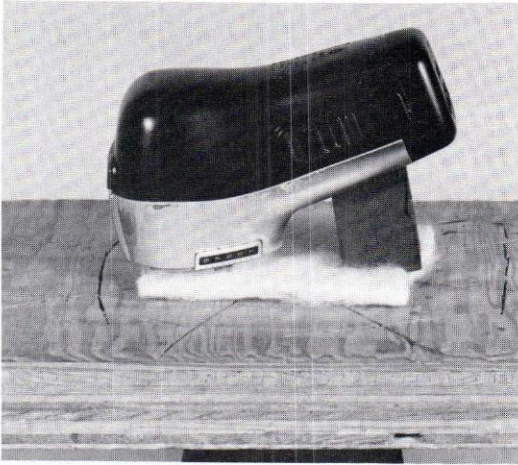


Figure 3. Razor mounted on vacuum table.

Figure 4. (right) Polyform<sup>®</sup> draped over razor.

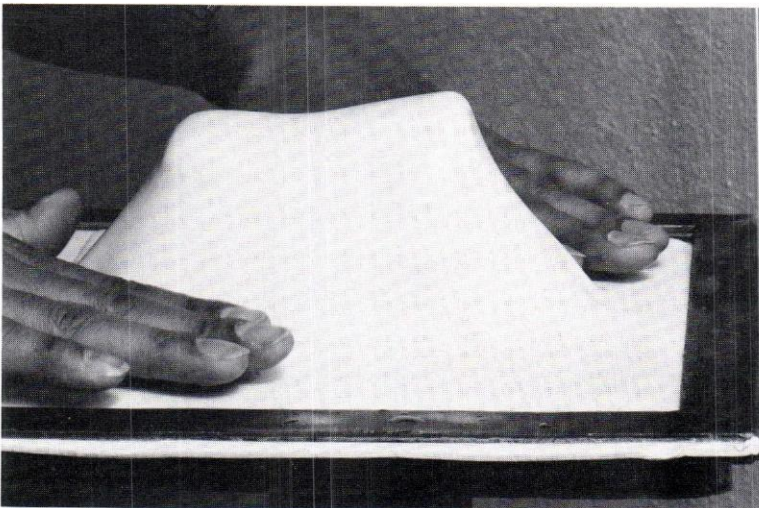
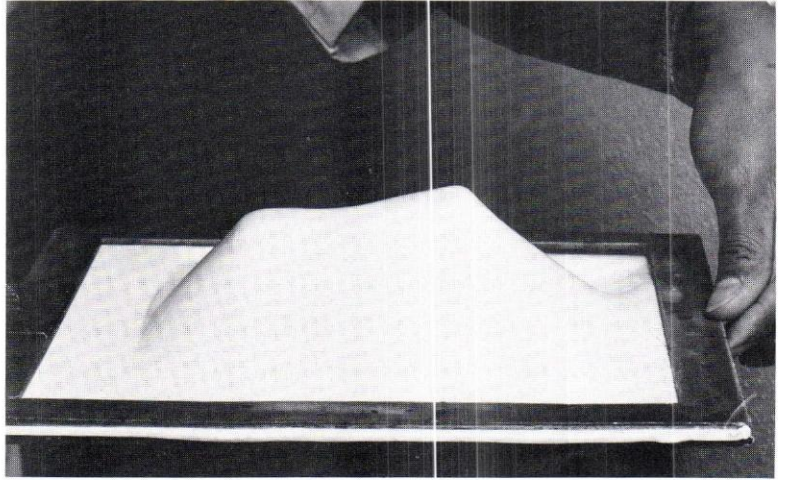


Figure 5. (left) Vacuum incorporated over table.

be formed is up and the area not to be formed is down on the vacuum table; place directly over the vacuum opening leading to the pump (Figure 2).

Prepare the vacuum table by cleaning it of all dust and debris. Then place a small piece of dacron felt or similar material over the vacuum hole to prevent plastic from clogging the opening (Figure 3). Adjust the vacuum pressure in the range of 10-15 pounds. Select the proper size frame for the item being formed (with smaller items a frame may not be needed). A ten inch frame is suitable for an item the size of an electric razor. Next, cut the Polyform<sup>®</sup> and



clamp in the frame with spring clamps (as the plastic heats, the clamps are needed to keep constant pressure on the frame). The plastic can be held by hand after heating, if necessary. The time needed to reach working temperature is about 60 seconds. After the plastic is heated to working temperature, remove the frame from the heat source (e.g., hydrocollator), and form over the item, ensuring a good seal. If the vacuum is too high or the plastic is stretched too much, punctures can be sealed easily before loss of an integral fit or working time.

It is important to use a source of moist heat, as dry heat from a heat gun or oven

tends to cause the plastic to stick to the item being molded. Dip the plastic in the hydrocollator at 160 degrees until the plastic begins to sag (approximately 60 seconds). Remove the plastic, and place over the item to be formed, allowing the plastic to sag approximately 1/4 inch above the table and completely around the item (Figure 4). The plastic can be pushed down by hand, but care should be taken not to leave fingerprints on the mold or punch holes in the plastic. Turn the vacuum on after the plastic stops sagging (Figures 5 & 6). Vacuum pressure can be turned off after two minutes, and the plastic should cool completely before removing the negative plastic im-

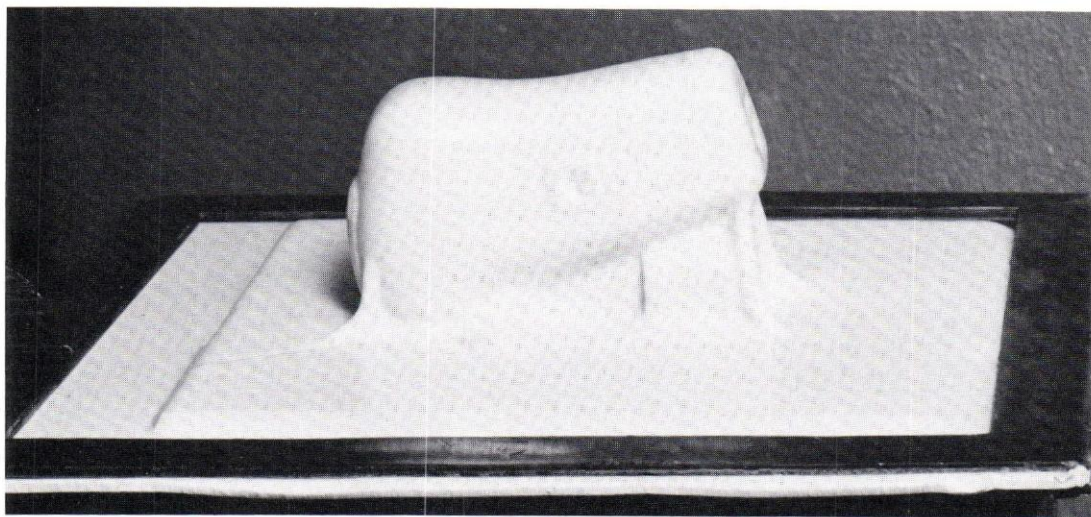


Figure 6. Complete vacuum.



Figure 7. (left) Rough trim lines.





Figure 8. (left) Finished trim lines.



Figure 9. Completed razor holder.

pression from the item. Quick cooling can be achieved by cool water or air gun. Open the molded plastic just enough to remove the item (Figure 7), and trim the plastic, leaving as much material as possible for a more secure fit. Attach any Velcro® straps with small speedy rivets, ensuring that all interior surfaces are flush and non-invasive on the molded item (Figure 8). Wrist supports can be incorporated during the vacuum forming process, or attached later if needed (Figure 9).

## CONCLUSION

This method is quick, efficient, and highly cosmetic for the patient. In addition, due to the higher technology available in orthotic and prosthetic laboratories, it should prove very useful to those practices involved in serving the severely disabled.

## AUTHORS

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