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A BELOW-KNEE WEIGHT-BEARING, PRESSURE-FORMED SOCKET TECHNIQUE

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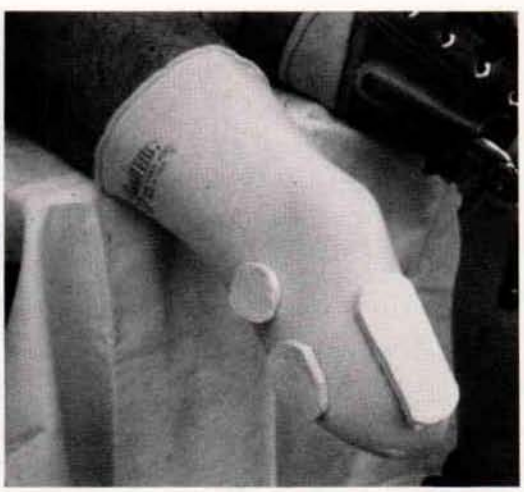
When my son was fitted for ski boots it occurred to me that we might use for fitting amputees some of the techniques used by ski-boot designers. The ski boot had an inflatable inner bladder. With the foot under weight-bearing, a conforming material similar to certain silicone compounds was injected into the bladder to give a perfect form-fitting in the attitude of weight-bearing.

The incentive to apply this technique to limb prosthetics was reinforced while I was watching a dentist take impressions for dentures. It then occurred to me that if this technique is sound for fitting ski boots and dentures the same principles should apply in lower-limb prosthetics.

The current method of fitting a below-knee amputee involves taking a negative cast in a non-weight-bearing condition, forming a positive model modifying it in size to preset dimensions by removing material to create pressure, and applying material to relieve pressure on the stump as appropriate. A socket is then molded over this model with the hope that, with small adjustments, it will fit.

Wouldn't it be wiser to develop a socket that will adjust to and fit the patient, rather than fit the patient to the socket? In trying to answer this question, the procedure described here was developed.

THE PROCEDURE



Measure the patient in the usual manner. Place a sheet of plastic wrap material, such as Saran, over the patient's stump to keep it clean of indelible pencil, and to make removal of the cast easy. If a wool sock is to be used, apply it, and then apply the plastic wrap. Apply a cast sock or tube gauze over the stump. Bond 1/4 in. felt over all pressure-sensitive areas—the crest of the tibia and the head of the fibula.

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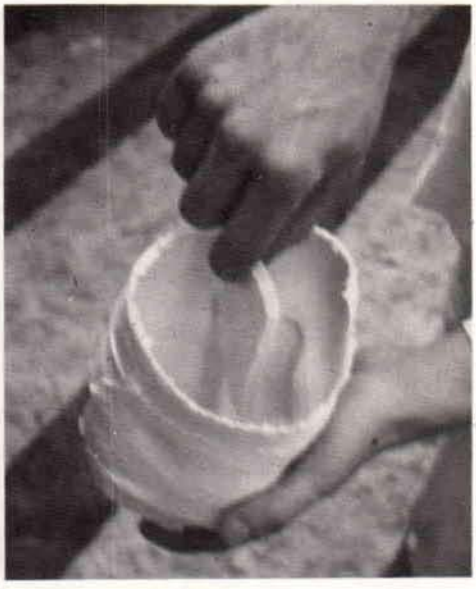
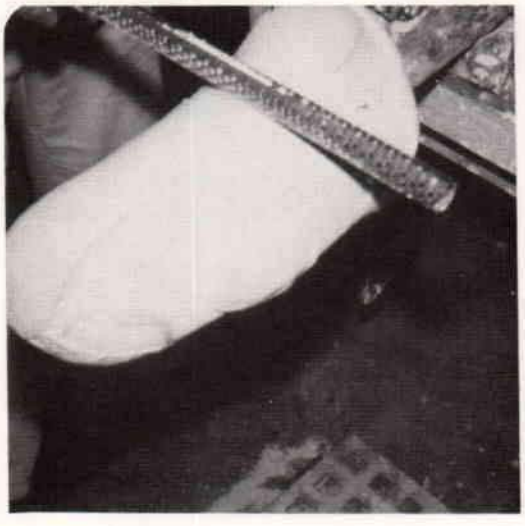
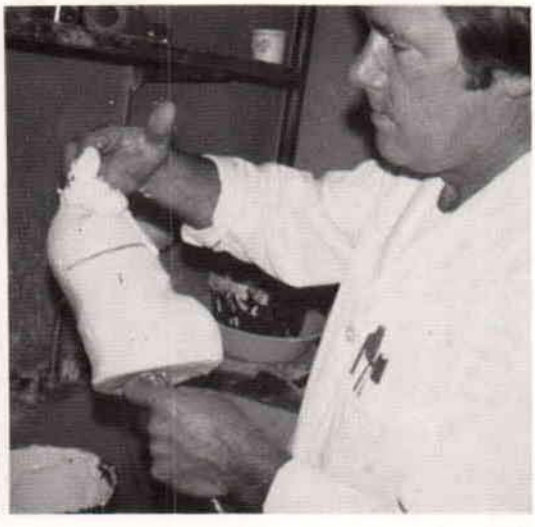
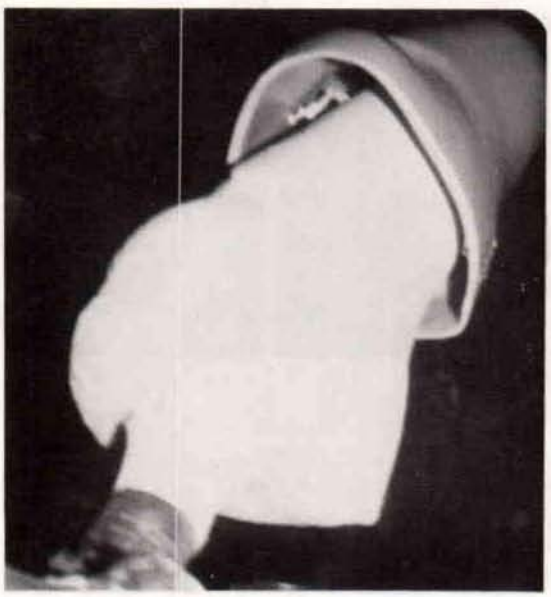


Using elastic plaster-of-Paris bandage 4 in. wide, wrap the stump in the usual manner, and reinforce with 3 in. or 4 in. wide regular plaster bandage. Remove the cast, and remove the tube gauze and felt buildup from negative cast.





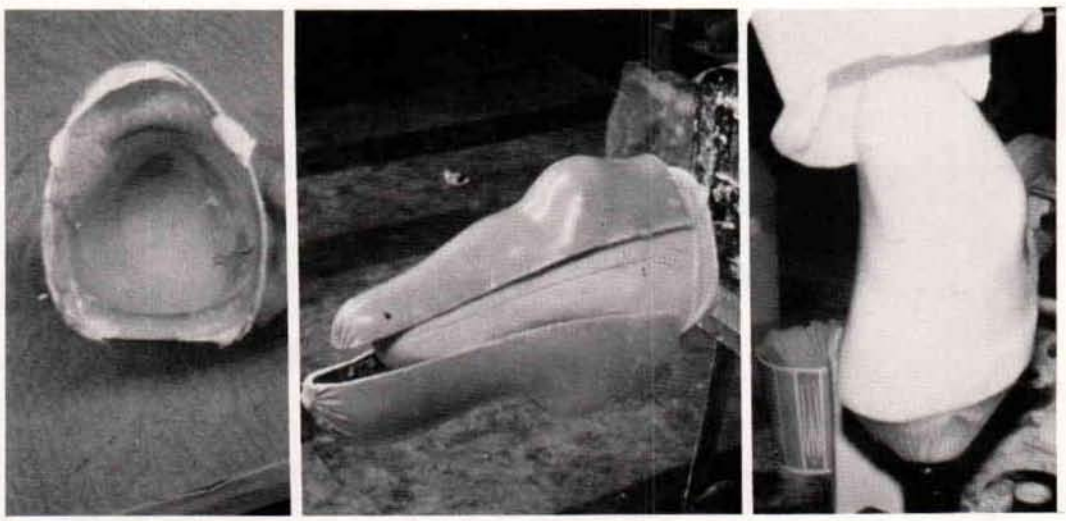
Pour the positive model, remove the negative cast, and modify in the usual manner, but do not touch areas that were covered with felt. Build up the distal end of the positive model at least 1 inch.



Make a check socket. This is a perfect application for vacuum-forming. Plaster bandages or laminates can, of course, be used. Drill two holes 1/4 in. in diameter in the distal end and rough up the inside surface of the socket. For the first fitting, apply the stump sock of choice, and place plastic "wrap" over the stump sock to act as a separator. An invaginated balloon will not work because it adheres to the alginate that is to be used later.

Mix about 1/2 pt. of dental impression cream or alginate which is more economical. Pour about 1/3 of the total amount in the distal part of the socket and, with a spatula, spread the rest around the remaining surface of the socket. It is necessary to work quickly at this point.

Place the socket on a fitting stool adjusted for height. Use some sort of pad to prevent slipping, and cover the drilled holes in the socket with your thumb and forefinger. Have the patient place his stump in the socket. Let the alginate escape through the distal holes until the patient is lowered into the socket to the proper level, at which time the holes are blocked. Alginate will now escape along the proximal brim of the socket.



As soon as the alginate has set up, remove the stump from the socket and immediately fill the socket with plaster. The rigid socket and alginate are removed by using a cast cutter. The mold resulting is a perfectly smooth, pressure-formed, positive model that can be used in any method of fabrication desired.

When this technique is used, patients can be fitted with sockets without soft liners.

Only a minimal amount of additional time is required. I feel that the technique allows better fitting of "problem" stumps, and that it may be used as a routine procedure to advantage, especially in central fabrication systems. Vacuum-forming procedures recently introduced make this approach to fitting even more attractive.