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The Sarasota Swim-Sports Prosthesis, A Technique For Providing A Dual Purpose Prosthesis

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INTRODUCTION

Originally intended to be used just in the water, with proper alignment and use of the Seattle Foot® made by Model and Instrument Development,† this prosthesis works equally as well on land. The concept of incorporating a chamber for negative buoyancy is not a new one, however the method of fabrication is different. In Florida, there is a great need for a prosthesis that can be used effectively in both environments.

Various types of prostheses have been made for use in the water, however, they all have something in common; they float. Some of these types have been more or less flotation devices. One type is made entirely with rigid foam. Plastic laminate encases the entire limb including the foot. It not only floats, but with such a hard and functionally long external keel, it traumatized the residual limb. The remainder of this type of prosthesis had similar problems. When a conventional SACH foot is used, the trauma to the residual limb is relieved, but not the problem of flotation. Another problem associated with the SACH foot is that the material decomposes after a period of time in water. Fortunately with the advent of the energy storing Seattle Foot® also came the life cast look, the tough external skin, and the non-porous internal parts made of Delrin. So one of my problems was solved, thanks to Model and Instrument Development.

Upon examining the second problem of how to prevent a prosthesis from floating, it was found there was no easy solution. Adding weight to a prosthesis seems easy enough, but having a patient use a 10 to 15 pound prosthesis would not be accepted very well. What was needed was a weight that could be easily added and removed as needed like the way a large ship or submarine takes on water for ballast. With this idea in mind, there was thought put into the ways of creating a chamber inside of the prosthesis. The most economical but sturdy material that could be found was P.V.C. (Poly Vinyl Chloride) pipe. Pipe of 2¼″ diameter was used to make the chamber, which was placed between the socket and the ankle block. Then, 2 pieces of ¾″ diameter pipe were placed posteriorly, one distally, and one proximally. These allowed for a gradual intake of water as the patient entered the water, thus making the prosthesis less buoyant. When the patient leaves the water, the fluid in the chamber drains out through the distal pipe leaving the prosthesis lighter.

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PROCEDURE

A P.T.B. socket utilizing supracondylar suspension in conjunction with a latex sleeve to water proof the inside is incorporated into the design. A Pelite™ insert was used in the test cases, but a hard socket could have been used. The socket, made with acrylic resin, is set up on a standard below knee alignment device, and the appropriate sized Seattle Foot® is then attached.

The patient is then fitted and allowed to walk in the parallel bars. However, the patient should walk barefoot to simulate the actual conditions of being on the beach or at the pool. The Seattle Foot® does allow the patient to wear sandals, thongs, or tennis shoes giving him or her a vast choice of shoes to wear.

When the fitting of the prosthesis is complete it is then transferred, using a vertical alignment device. After removing the BK adjustable alignment device a durathane ankle block is used at the distal end. It must be cut down to about two inches in height to allow the longest piece of P.V.C. pipe to be used. The ankle block is then sealed inside so that no moisure can affect the foam and the correct length of 2¼″ P.V.C. pipe is selected and cut. The pipe will have to be long enough to fit down inside the ankle block and cradle the socket. However, before permanently bonding the pipe to the ankle block with sealing resin, acrylic sealing resin mixed with a filler should be poured into the center of the ankle block, completely covering the foot bolt. Make sure to lubricate the foot bolt for easy removal after the resin cures. Proceed to bond the socket to the pipe, again with sealing resin, making it completely water tight. Then, using a ¾″ hole saw, make two holes, one as far distal on the posterior as you can go on the chamber and the other as far proximal on the posterior.

Two pieces of ¾″ diameter P.V.C. pipe, approximately 6″ in length, are cut and bonded into the holes. Keep the distal one horizontal but give the proximal one an upward tilt (Figure 1). It is important to seal these well with P.V.C. cement,

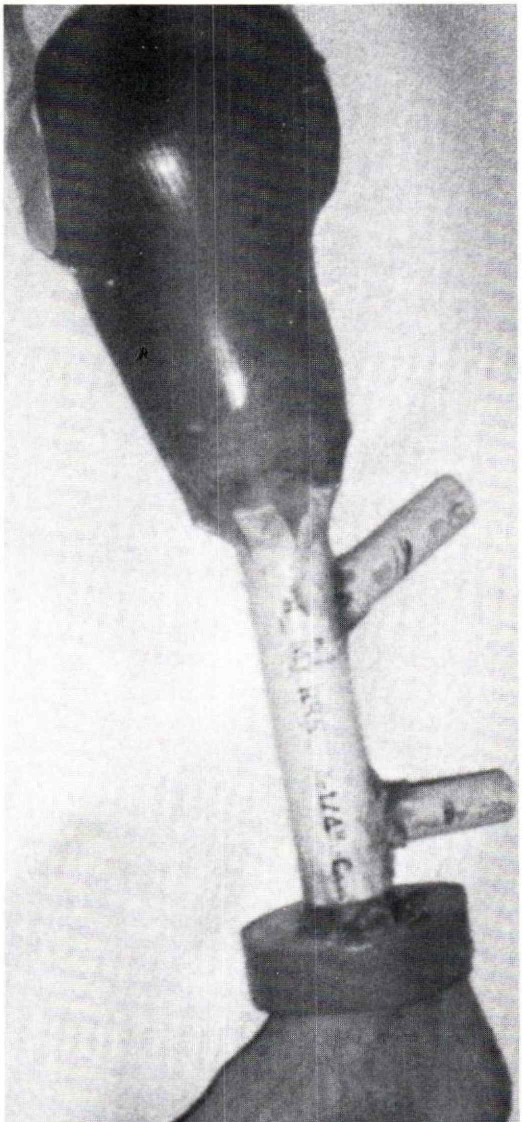

Figure 1. Medial view of transferred prosthesis ready to be foamed up for shaping. Note the upward tilt of proximal tube; distal tube remains horizontal.

Figure 2. Anterior view of completed prosthesis on patient.

Figure 3. Posterior view of prosthesis on patient. Note later sleeve as water barrier, and entry/exit holes for ballast.

as any leakage will cause the surrounding foam to deteriorate. Masking tape is placed over the ends of the ¾″ diameter P.V.C. pipe, and the socket is then foamed up and shaped (Figures 2 & 3).

Bonding of the foot to the prosthesis needs careful consideration. The hot glue method that Model and Instrument Development recommends is used. In addition, a bead of glue around the top edge of the foot is used to ensure a perfect seal. The final step after tightening the bolt, provided with the foot, is to fill the bolt hole with hot glue to prevent any corrosion.

CONCLUSION

With this technique, the patient has a prosthesis that can be used equally as well on land as in the water. He/she can walk right from the tennis courts or golf course directly into the pool or ocean using the same limb. This provides the patient with the benefits of two prostheses in one design.

AUTHOR

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