The Orthoglas Transparent Test Socket—An Old Idea, A New Technology

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INTRODUCTION

A comfortable functional fit of the socket in a prosthesis is the first, and most important, aspect of prosthetic fitting. A great amount of ingenuity and effort have gone into methods to ensure an excellent socket fit, including special casting procedures and devices, modification techniques, socket materials and padding, and the use of test sockets. Test socket procedures, frequently called "check sockets" have been used and taught for over forty years, but without the advantage of transparency. Materials such as wax, plaster bandage and a variety of resins have been used.

In his presentation to the Minnesota Physiatric Association in May, 1982, Frank Zondlo, M.D., stated that the benefits of using the TTS far outweighed the additional cost. If a lower extremity amputee is prevented from returning to a normal, productive life due to an ill-fitting socket, the cost to society can be substantial. As an above knee amputee and a resident physician in Physical Medicine and Rehabilitation at the University of Minnesota, Dr. Zondlo has had first hand experience with Transparent Test Sockets. He believes the TTS provides a more objective way of determining proper socket fit by allowing the prosthetist to see what is happening inside the socket during both static weight bearing and dynamic alignment.

USE OF TEST SOCKETS

Prosthetists throughout the country who have been using TTS, have begun to develop criteria to "read" the tissue within the socket. Primary criterion so far is to achieve a slight, uniform blanching over the entire residual limb. Excessive pressure may be indicated by a very white blanching. It can be relieved by giving the area more space or by increasing the pressure around the area. Lack of total contact is indicated by a reddish tinge (erythema) and if excessive, some bluing (Fig. 1-7). Various materials (alginate, pour-a-pad, etc.) can be injected into the socket and allowed to migrate during weight bearing to fill voids and assure total contact. Pressure sensitive areas can be located by probing with a corset stay or by probing through holes drilled into the test socket.

ADVANTAGES

The advantages of any type of test socket are as follows:

- Socket fit can be evaluated and minor changes be made without ruining the final socket.
- Major changes can be noted and made on the positive plaster model. In some

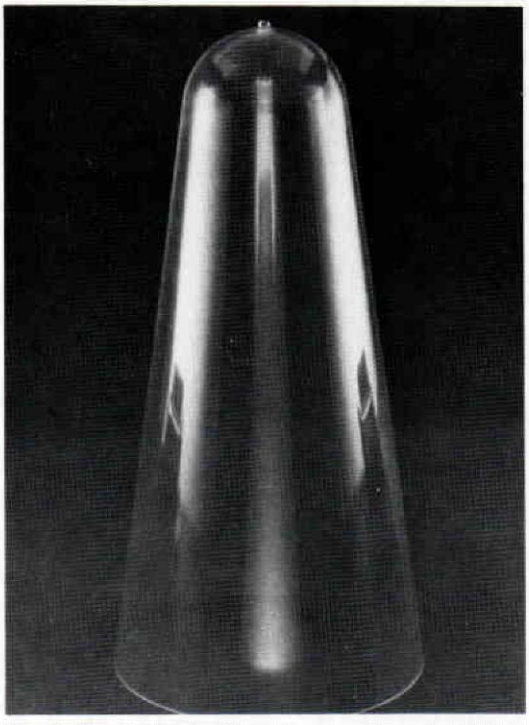


Fig. 1. The Orthoglas Cone is an acrylic material that comes preformed in a cone shape for vacuum forming.

cases, these can also be made on the test socket.

- If the test socket is attached to the other components of the prosthesis, socket fit can also be evaluated during walking.
- Since the test socket will be discarded anyway, the prosthetist is more likely to make adjustments, sometimes on a trial and error basis, to improve the fit.

DISADVANTAGES

Although test sockets have many advantages, they are not used by many practitioners who consider the following items to be disadvantages to using them:

- Socket fit does not seem to be a problem with most patients, so test sockets are not necessary.
- Test sockets are costly in time and money, requiring an extra patient appointment and the fabrication of an additional socket, often using expensive materials and requiring special equipment.
- The effect of test sockets is diminished when prosthetic socks are worn by the patient, as actual skin contact cannot be seen.

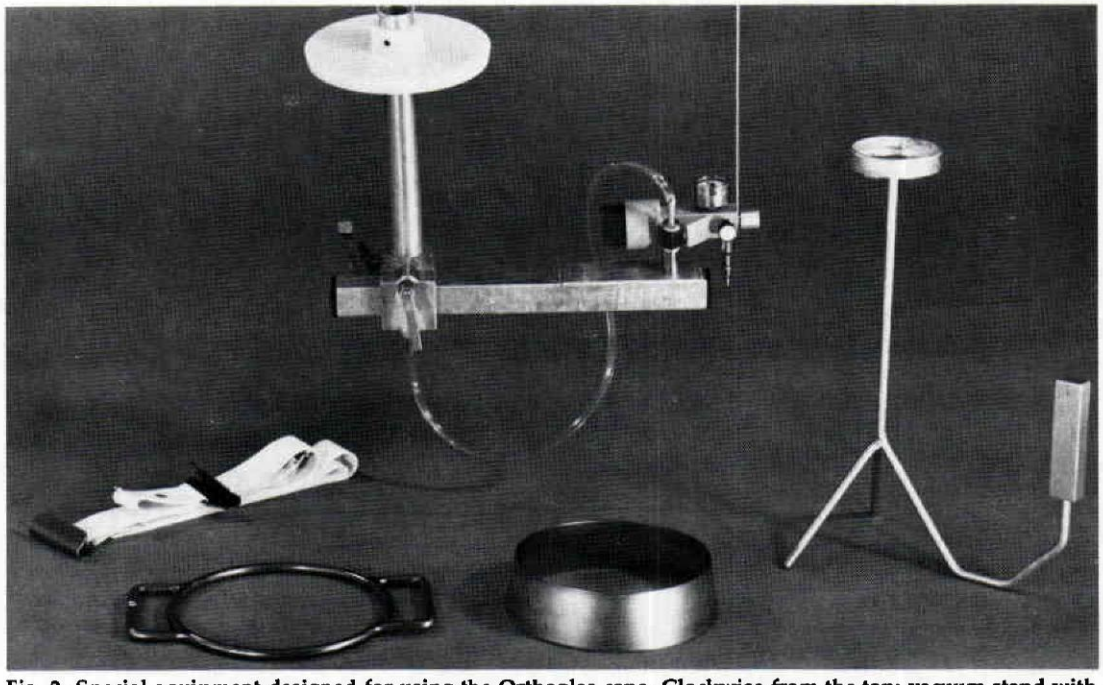


Fig. 2. Special equipment designed for using the Orthoglas cone. Clockwise from the top: vacuum stand with Delrin Ring, oven stand for the Orthoglas Cone, inner and outer rings, and foot strap.

• A test socket is not effective unless the patient walks while wearing it. Many test sockets are used statically and the effect of walking forces cannot be determined.

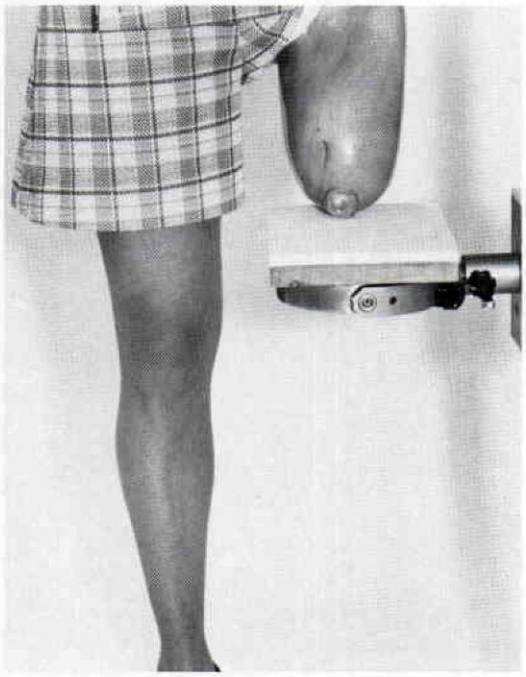
METHOD

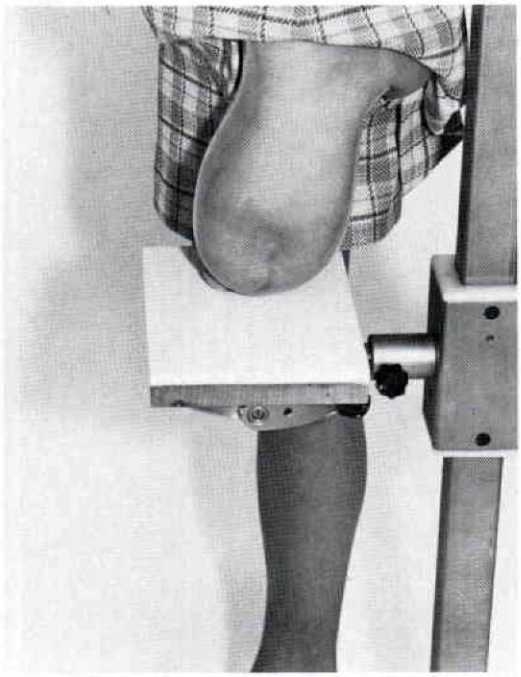
A new, simplified technology has been developed for fabricating the transparent test socket. It is a thermoplastic, acrylic material called ORTHOGLAS* and it comes in the shape of a cone rather than a flat sheet. Compared to plastic sheet material, the cone shape is more advantageous for vacuum forming prosthetic sockets. There is no time wasted measuring and cutting sheet material to size and there is less material waste. The cone retains a more uniform wall thickness during heating and forming (Fig. 8).

The ORTHOGLAS Cone has several time-saving properties. It is ready to use; no curing or drying is necessary. It can be vacuum formed over a wet or dry plaster cast. ORTHOGLAS is thermoplastic so it

Fig. 3. Vacuum forming a transparent test socket.

*Available from Otto Bock Orthopedic Industries





Figs. 4-A & 4-B. Using an Orthoglas TTS to evaluate the fit of an Above Knee suction socket.

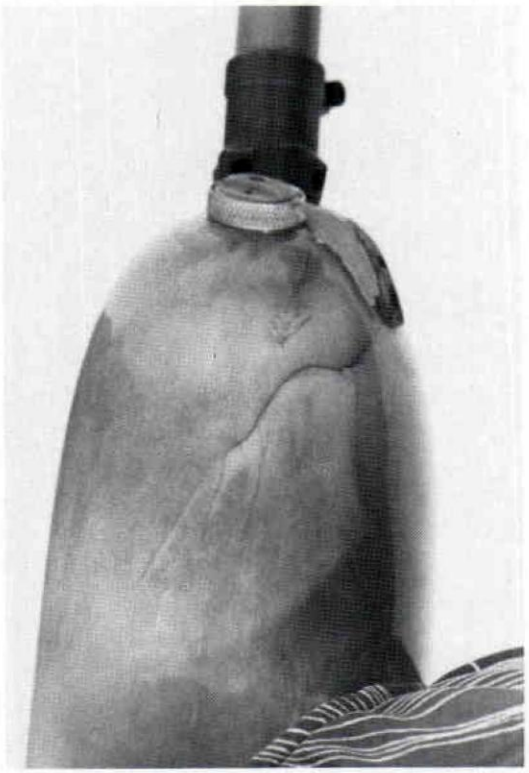


Fig. 5. The Orthoglas TTS is used for dynamic alignment by bonding it to a pylon with acrylic putty.

can be heated and reshaped for minor modifications.

Special tools were designed to ease the vacuum forming process. An inner ring and an outer ring* with handles are placed around the base of the ORTHOGLAS Cone. The Cone with rings is placed on a stand in an air-circulating oven at 190°C (375°F) for approximately ten minutes. The plaster model with a standard water pipe is placed into a vacuum pipe with delrin disk which is connected to the vacuum system (Fig. 9).

After ten minutes, or when the ORTHOGLAS Cone is milky white and slightly concave at the top, it is taken out of the oven and pulled over the plaster model. The base of the Cone will conform to the delrin disk creating a vacuum seal. Vacuum is applied and after the Cone has formed to the plaster model and cooled, it can be trimmed and finished using conventional grinding and polishing tools (Fig. 10).

Once all fitting evaluations and any needed corrections have been made to the transparent test socket during both static weight bearing and dynamic alignment, the definitive prosthesis can be made. Another significant advantage of ORTHOGLAS is that all acrylic resins, acrylic putties and polyurethane foams will bond to it without special surface preparation. Instead of laminating an inner socket, one can be vacuum formed much faster with an ORTHOGLAS Cone. Properly reinforced with an exterior lamination of ORTHOCRYL Resin, the ORTHOGLAS Cone can be used as the inner socket in the definitive prosthesis.

Patient responses to TTS fittings are very favorable, opening better lines of communication between the amputee and prosthetist. The amputee takes a more active role in the fitting and has more understanding of the complexity of prosthetic fit as well as the importance of accurate communication.

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