

Transparent Socket Fabrication

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The desirability of seeing an amputation stump in the prosthetic socket has long been recognized. The transparent socket as a fitting aid would solve many problems such as pressure pain, etc. It can be used as a definitive socket or as a negative mold. Recognizing this problem and consulting with several colleagues at New York University who had devised a technique for fabrication of a transparent socket, the following fabrication method was developed.

Casting of the Below-Knee Stump

A negative cast is taken in the usual way, then removed from the amputation stump. An extension made from plaster of paris bandages is then added to the proximal end of the cast, approximately two (2) inches high. The cast is filled

with plaster of paris using the slush method, or by forcing an eight-ounce paper cup as far as possible into the cast. This will make a thin wall mold. Select a length of pipe and prepare it for suction and insert it into the cast. After the plaster has hardened, remove the negative cast in the usual way.

Modification of the Positive Model

Modify the positive model, as necessary. After all modifications are made and the model is smooth, using a round surform blade, cut a groove $\frac{1}{2}$ inch deep and $\frac{1}{2}$ inch wide that extends completely around the mold approximately $\frac{1}{2}$ inch from the proximal edge. At this point if time permits place the cast in an oven approximately 150° F for four (4) hours so it will be thoroughly dry.

Fabrication of the Transparent Socket

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Materials required for fabrication are:

- Parting lacquer
- Vacuum pump
- PVA sheet and bags
- Clear cast resin^R
- Clear cast catalyst
- Clear cast non-fracture additive
- 4134 laminac resin
- Fiberglass roving
- Fiberglass stockinette
- Pressure sensitive tape
- 16 oz. cup
- Tongue depressor
- Cone for funnel
- Lubricant
- String

The step-by-step fabrication procedure is as follows:

(1) Coat the cast with lacquer and apply the suction base.

(2) Lubricate the socket and pull PVA over the cast. *Caution*—The shiny side of the PVA must be on the outside.

(3) Tie off and apply vacuum so that the PVA conforms to all irregular shapes of the cast.

(4) Saturate a towel with acetone and dry the PVA while the vacuum is running. It is important that the PVA not break because the lubricant will cause the resin to remain tacky after it has cured.

(5) Apply a roll of fiberglass roving starting on the lateral side leaving six (6) inches below the cast. Bring the roving up over the cast and down the medial aspect. Make one complete turn around the pipe and bring the roving up over the patella and the tibial crest. Approximately $\frac{1}{2}$ inch from the distal end of the tibia start wrapping the roving around the cast

taking care to keep it tight. Place the wraps approximately $\frac{3}{4}$ inch apart making certain the wrap crosses the head of the fibula, the tibial tubercle, the indentation for the patellar tendon bar and the patella. Make the last wrap approximately $\frac{1}{2}$ inch from the groove. On the proximal section, bring the roving down and tie it the six (6) inches that was left previously.

(6) If the socket is to be used for definitive purposes substitute fiberglass stockinette for the fiberglass roving. The stockinette can be applied in up to three (3) layers. Clarity is best when using roving only and decreases with each layer of stockinette applied, however, one layer of fiberglass stockinette provides considerable strength and good clarity.

(7) Take a PVA bag, pull it over the cast using the most convenient method. *Caution*—The PVA bag must not bind on the distal part of the cast. Also, because this bag will touch the inner bag, some difficulty may be experienced. Take care not to move the fiberglass roving.

(8) If air is available, inflate the bag and pull down.

(9) If no air is available, mix a small amount of resin using the formula given below and pour it in the bag making certain the cast is completely covered with the resin.

(10) After the bag is pulled down and tied, take a piece of sixteen pound twine long enough to encircle the cast three times. Place the string in the groove, pull it tight and tie.

(11) Cover the string with pres-

sure sensitive tape applying as much pressure as possible.

(12) Make a funnel, place it in the bag and attach the bag and funnel to an overhead pulley.

(13) The resin used to fabricate the socket is a mixture of 80% clear cast^R resin and 20% 4134 laminac resin plus a clear cast non-fracture additive. For a medium size stump approximately 4½ inches long 500 grams of resin is sufficient. However, there must be enough resin to form a cast of minimum ¼ inch thickness with a distal extension of two (2) inches. Mix the resins adding the non-fracture additive according to manufacturer's instructions and using the catalyst supplied with the clear cast^R. Add approximately four grams catalyst per 100 grams resin. (The resin will set in approximately 45 minutes.) Mix well and pour into the PVA bag.

(14) Massage the resin into the fiberglass. The fiberglass must be completely saturated with the resin; this point is reached when the strands of glass seem to disappear.

(15) Force the resin into the PVA bag so that there is a minimum of ¼ inch thickness all over the cast. There should be enough resin to have a two-inch extension on the distal end of the cast.

(16) After forcing the resin down, twist and tie the PVA bag so that constant pressure is maintained. The head of the fibula, patella, crest of the tibia and the belly of the gastrocnemius will present a problem if the PVA is stretched too tight.

(17) Careful watch must be maintained just as the resin starts to gel. There is a period of approximately one minute when the gelled resin can be moved en masse over thin areas. After this it must not be moved. The PVA should not be removed for a minimum of three (3) hours after the resin has set.

(18) If removing the socket is a problem it may be cut down each side with a cast cutter. The cuts are then filled with clear cast resin that is under catalysis.

(19) The socket is cut, trimmed and attached to an adjustable unit by drilling and tapping four (4) holes for 10-32 machine screws on the distal buildup.

(20) If material has to be removed for fitting, the clarity can be restored by spraying on one coat of clear lacquer, or by painting on a thin coat of clear cast resin that is under catalysis.

Conclusion

The advantages of a transparent socket are the ability to observe the stump during static and dynamic alignment and all phases of the walking cycle. It may, when correctly fitted, be incorporated into the definitive prosthesis. Total fabrication time is approximately two (2) hours.

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