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The ROL[1] Rotator

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The staff at Rochester Orthopedic Laboratories has long believed in the concept of controlled rotation about the long axis of an artificial leg, often referred to as "transverse rotation." We have used all available rotation units as they have been developed, and found them functionally satisfactory, but for our purposes lacking certain qualities necessary for our continued use. First, the available units are not easily repaired; in fact, failure of the unit requires complete replacement. Second, all units placed in the prostheses of active patients needed replacement in a short period of time—two to twelve months. Third, it was expressed to us by some patients that they required adjustable torque resistances, and to date there is no readily available unit that allows for adjustment. Other problems are, the lighter units are not as strong as heavier ones, and when either was used the patient complained about replacement or weight respectively. We set out to see if some of these problems could be solved and make rotation as practical as it is beneficial for the patient.

On February 27, 1976 the first ROL Rotator was delivered to a very active male mechanic with a knee disarticulation who was 74 in. in height and weighed 205 lbs. After three months of use, no appreciable wear could be detected and no failure of any components had occurred. Therefore, we proceeded with other installations. Since 1976 we have installed approximately 80 rotators. The design has not been modified except for minor changes in materials. It remains as seen in Figure 1.

MATERIALS

The ROL Rotator consists of:

1. An ankle block with a ½ - 24 bolt receiver of 1-¼ in. long steel.
2. A medial set screw to lock bolt down (¼ - 28).
3. Two ¼-in. thick phenolic plates (one proximal, one distal) to act as rubber retainers, and to provide strength.
4. Two Teflon bearing surfaces to reduce friction.
5. A rubber sheet, 1/16-in. thick, under distal Teflon surface to promote even wear.
6. Rubber block, 1-in. O.D., posteriorly to provide torque resistance.
7. Compression bearing with ½-in. dia. hole to eliminate resistance of the bolt on the foot.
8. Foot bolt, ½ - 24, 3 in. long.

Fig. 1. A PTB prosthesis that uses a ROL rotator.

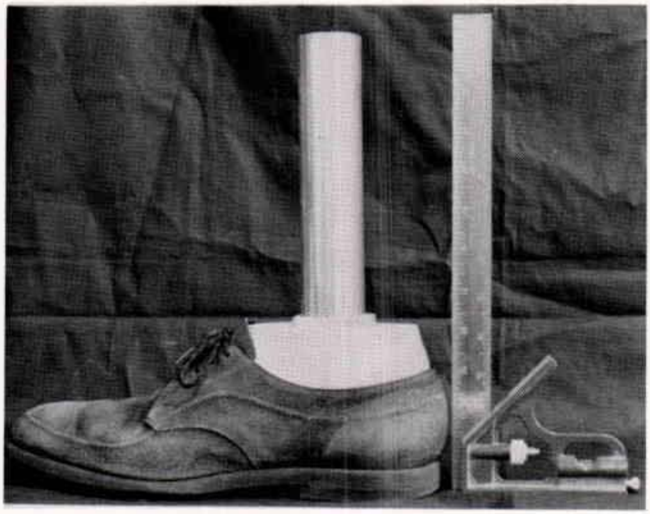

Fig. 2. The proximal surface of the SACH foot is sanded to provide 2 deg. of anterior tilt of the pylon of the adjustable leg.

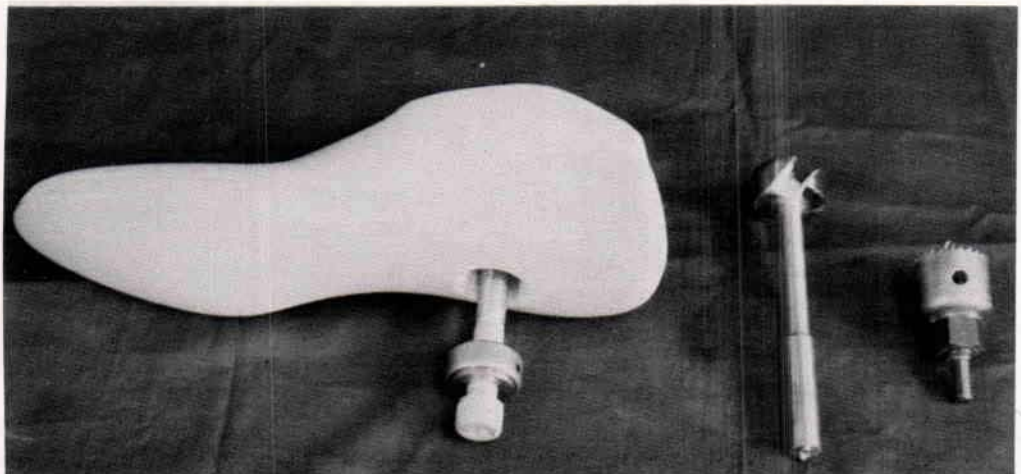

Fig. 3. The hole in the bottom of the SACH foot is enlarged to accept the bearing of the rotator.

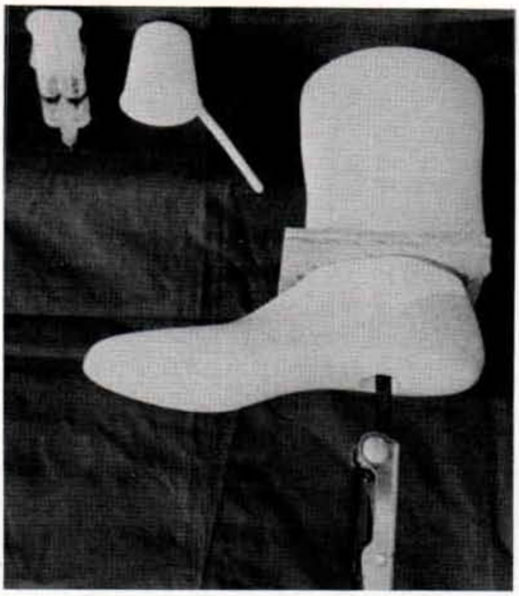

Fig. 4. A phenolic plate is attached to the proximal surface of the foot with epoxy.

INSTALLATION

The Sach foot to be used is placed in the shoe. The proximal surface is sanded to provide 2 deg. of anterior tilt of the pylon of the adjustable leg (Fig. 2). The hole in the bottom of the foot is then enlarged to accept the bearing (Fig. 3). A 1-¼-in. dia. hole saw is used, and the base of the hole is squared with a Forstner bit. The base of the hole must be parallel to the proximal surface of the foot and the hole for the bolt should be at the center to eliminate any possible binding of the unit. (We now have in use a bearing with a smaller outside diameter which eliminates most of this step, but at this time we are not ready to recommend it for use as it has not been tested thoroughly. The large bearing is shown in Fig. 3.)

The phenolic plate is glued to the proximal surface of the foot with a reliable epoxy (Fig. 4), taking care to center the rubber over the keel posteriorly. The

Fig. 5. Epoxy or polyester resin is poured around the posterior aspect of the foot plug to keep it from rotating with respect to the proximal plate.

plate with the rubber layer is used under the Teflon atop the foot to simplify finishing.

A foot plug, tapped for ½ - 24 bolt, and with a set screw in either side is attached to the subassembly. Epoxy or polyester resin is poured around the posterior aspect to keep it from rotating on the proximal plate (Fig. 5). It is now ready to fit (Figs. 6 and 7). After fitting, the complete rotator and foot are removed and transferred in the usual manner (Figs. 8 and 9). The medial set screw in the foot plug must be loosened before the bolt is removed. Toe-out is retained in the same manner as a normal transfer. The toe-out is set and the proximal plate is fastened with epoxy after the plastic is removed from the posterior proximal area. The rotation area obviously must be free of plastic.

Torque resistance is reduced simply by enlarging the hole in the posterior rubber and is increased by installing solid rubber.

When the rotator is being assembled for delivery, there are several points to remember. First, the Teflon around the rubber retainer hole should be checked to make sure that all sharp edges have been removed. Shearing of the rubber can be nearly eliminated if this simple procedure is followed. Second, the bolt should be tightened completely and then backed off until complete return of the foot is effected on rotation, but no pronounced gapping occurs under stress. Tightening the bolt first ensures that the bearing is well seated on the keel. Third, to adjust the resistance, several different courses may be taken. Rubber of different durometers may be used or, even simpler, a hole may be punched in the center of the rubber and enlarged until the desired resistance is attained. Small amounts of Silicone or Vaseline may be applied to the Teflon, though need for this has not been proven.

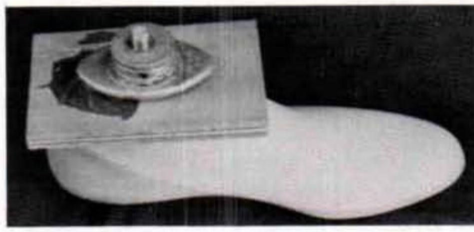

Fig. 6. Foot and rotator ready for fitting.

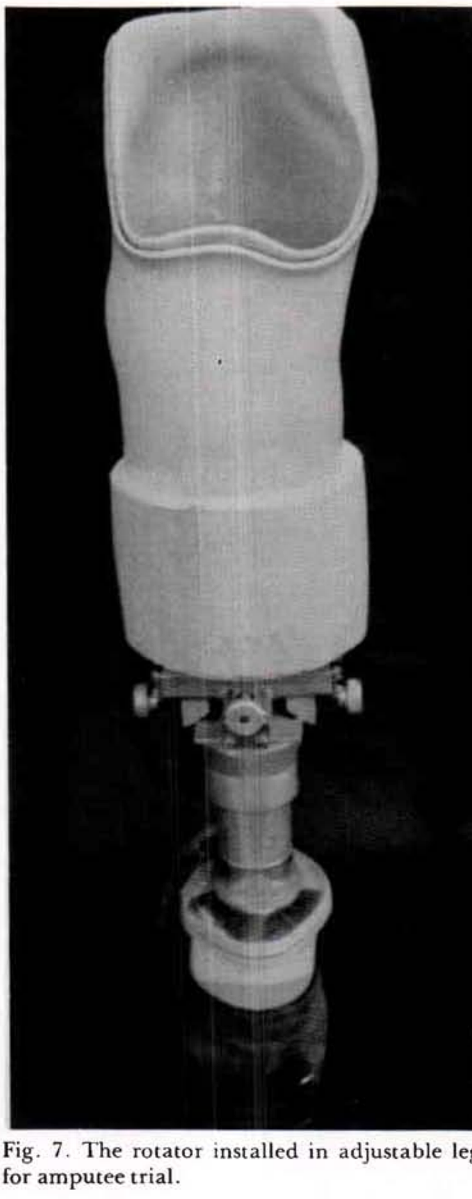

Fig. 7. The rotator installed in adjustable leg for amputee trial.

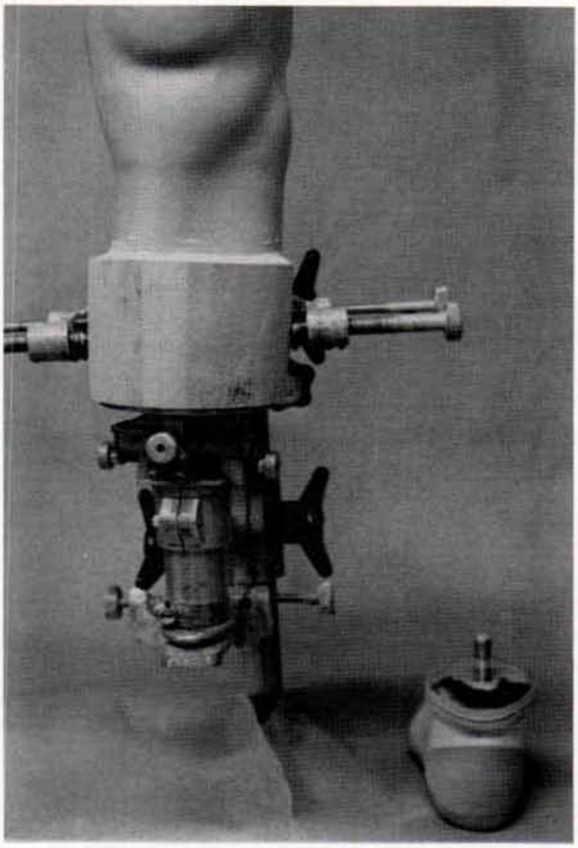

Fig. 8. The rotator-and-foot assembly is removed from the adjustable leg.

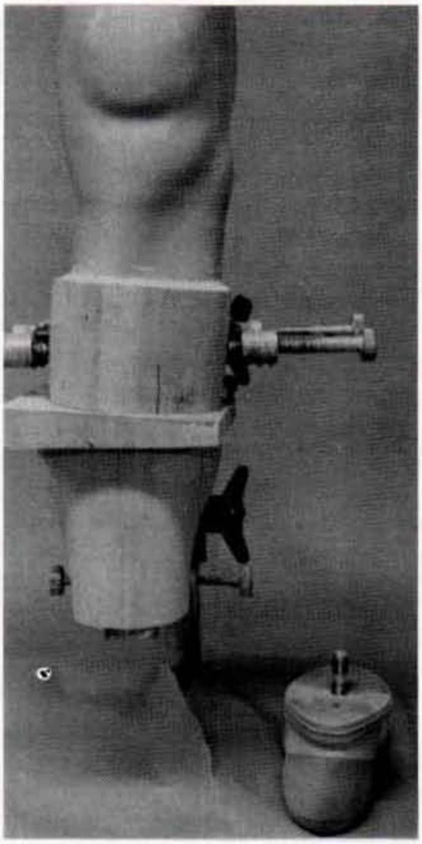

Fig. 9. Fabrication of the PTB is carried out in the usual manner.

SUMMARY

When properly installed, the ROL Rotator is virtually trouble free. Worn components can be quickly, easily, and economically replaced. Torque adjustments are quick and simple. The six-ounce weight the rotator adds to the prosthesis is well accepted. The rotator is very cosmetically acceptable. Repairs have consisted of rubber replacement on several occasions and in two instances with very active patients the Teflon wore out and was replaced. In short, all the rotators we have installed since February 1976, to the best of our knowledge, are still in operation and none have failed or been removed for any reason.

Footnote

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