Prosthetic Consideration for the Lower Extremity Child Amputee

by WILLIAM A. TOSBERG, C.P. & O.

Technical Director, Prosthetics Services
Institute of Rehabilitation Medicine
New York University Medical Center, New York, N.Y.

It is essential that prosthetic prescriptions are based on the requirements of the individual patient. This is equally true in the adult as well as in the child amputee. These requirements take into account the emotional as well as their functional needs. In the child amputee one has to consider also the emotional needs of the parents.

In prescription for a juvenile patient one has to distinguish between surgical amputation and the congenital absence of a limb. Amputations may be performed for accidents, disease, or for cosmetic purposes. Amputations for cosmetic reasons are generally not performed before the age of adolescence.

Prosthetic replacements for traumatic amputations in children are very similar to those for adults in design as well as in material. One has to consider, however, that a child is very active, and therefore prostheses should be constructed of sufficient strength and of a design which requires only minimal maintenance.

In a very young child, where no gait pattern is as yet established, it is advisable to provide a below-knee prosthesis with knee joints, side-bars, thigh lacer, hip joint, and sometimes even a pelvic belt. These additions may be removed as an acceptable gait pattern becomes established.

In above-knee amputations, suction sockets may be prescribed if the stump is well healed and only minimal stump changes are expected. An auxiliary suspension, however, is indicated—either Silesian belt or hip joint and pelvic belt. For children a SACH foot is preferred because it is considered to be stronger, water-proof, and requires less maintenance than an articulated foot.

Amputation resulting from disease is most often the result of malignancy because peripheral vascular problems are relatively rare in childhood. It is advisable that children be fitted at the earliest possible date at which a prosthesis is medically indicated. Immediate post-operative prosthetic fittings are generally very successful with children.

Growth is one of the predominant problems in the prosthetic fitting for children. One has to distinguish between circumferential growth and linear growth. In order to compensate for circumferential growth, extra wall thickness in lower extremity prostheses constructed from wood could make it possible to remove material as the circumference of the stump increases. In prostheses constructed of plastic, it is possible to fit the socket with one or two inserts, these to be removed as indicated. Linear growth is compensated for by cutting the prosthesis and adding to its length.

Figure 1—Right Amelia; left Syme.

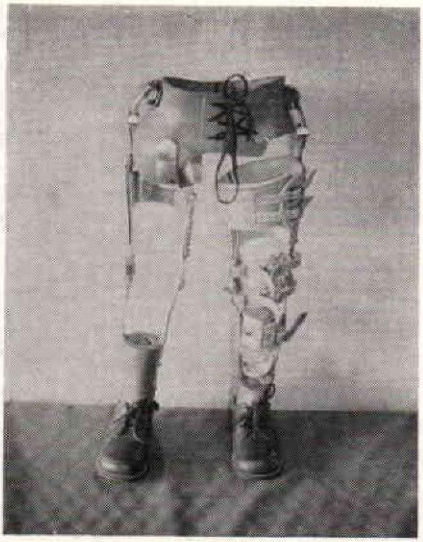


Figure 2—First set of Temporary Prostheses.

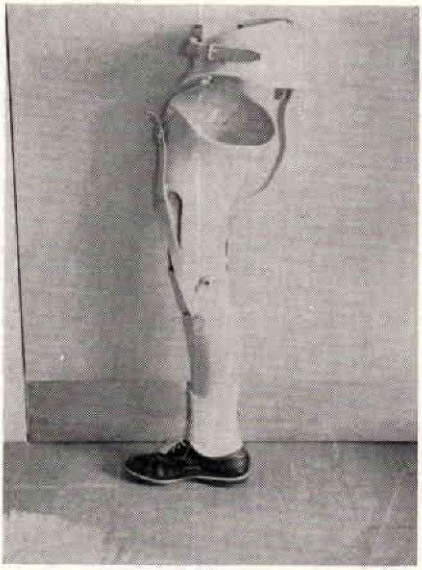
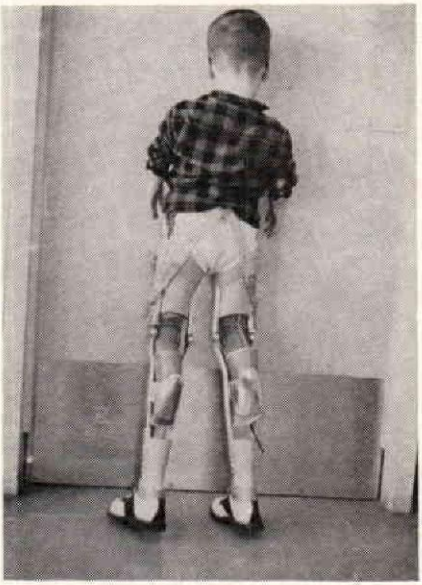
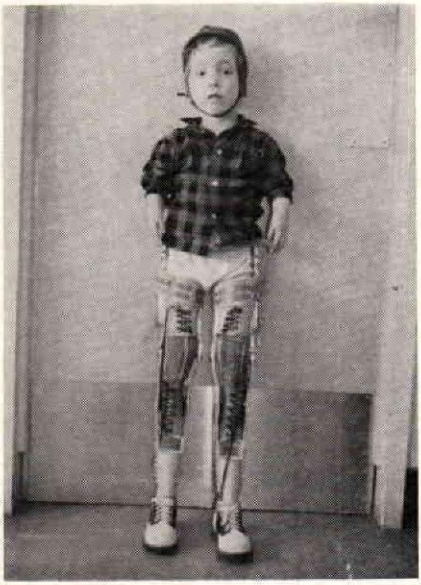


Figure 3—First set of Permanent Prostheses.

Figure 4—Bilateral Lower Extremity Hemimelia.





Figures 5 and 6—Posterior and Anterior views of Temporary Prostheses.

It has also been recommended, at least in early childhood, to elevate the shoe on the nonamputated side by approximately 3/8 inch and to fit the prosthesis to this increased length. The added length of the affected side could be removed gradually, until equal length is obtained. It is then possible to gradually add to the shoe of the affected side. In this manner growth of almost ¾ inch can be compensated for.

The Orthopedic and Prosthetic Appliance Journal of March 1967 carries an article by Howard V. Mooney which describes a different procedure to keep children's prostheses at the most functional length.

The majority of prostheses for children are constructed, however, to compensate for a congenital birth defect. Most of these anomalies are found in the upper extremities, the most frequent one being the absence of one hand or part of the forearm. Anomalies of the lower extremities often consist of either proximal or distal phocomelia, either unilateral or bilateral. Yet many other deficiencies are also seen. Dislocation of the hip joints are often associated with these disabilities.

There can be no standard pattern for prosthetic replacement since the clinical picture varies considerably. In the case of distal phocomelia with relatively little shortening of the extremity, a built-up shoe may be the best approach. Under certain conditions, the removal of a functionally useless foot allows construction of a standard below-knee prosthesis. The same is true in the cases of proximal phocomelia where standard above-knee prostheses can be utilized. Although a normal, or near normal foot may be present, end-bearing or accepted above-knee weightbearing principles often cannot be resorted to because of abnormal hip joints. Limited ischial bearing or exaggerated gluteal support has to be utilized. Wherever there is a freely movable ankle joint the remaining foot is fitted in extreme equinus to prevent unsightly protuberances in the prostheses. In order to insert the stump into the socket it is usually necessary to provide an anterior opening.

Time of fitting with prostheses depends upon the child's development.

Figure 7—Bilateral Acheiria; unilateral Terminal Hemimelia Transverse.

Fitting for functional upper extremity prostheses coincides with the ability of the child to sit erect. However, nonfunctional prostheses have been applied as early as the age of six months. Lower extremity prostheses are provided whenever the child shows an attempt to stand.

Since growth is rather rapid and anomalies vary considerably, it has been the practice at the Institute of Rehabilitation Medicine to provide brace-type appliances with ischial gluteal weightbearing at an early age. A non-articulated foot is used. These braces allow for a maximum adjustment. Replacement with a definitive prosthesis usually takes place before school age.

In cases of bilateral lower extremity amelia where sitting without a device is impossible or extremely difficult, a sitting device is constructed from a cast of the lower body part, which is attached to a board. Where body conformation allows, this is a closed socket; otherwise, there are lateral openings. The socket should be wide enough in its lower dimensions to allow for diapers.

Prostheses for bilateral amelia should allow for hip locks and knee locks in order to allow a swing-through gait, although Canadian hip-type prostheses have been successful in isolated cases.

One problem which is unique to the child amputee is the overgrowth of bony tissues, especially in the acquired amputation. Quite often multiple shortening of the bones have been resorted to in order to maintain a stump free of pain.

Training of lower extremity amputees is an important requirement because it is very difficult to correct faulty gait patterns once they are established.

Constant examination of skin in weightbearing areas is essential to determine need for adjustment or replacement.

It is also necessary to have periodic checks of all mechanical parts to determine wear and breakage.