

## A MODIFIED STANDING ORTHOSIS

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The importance of standing in rehabilitation of the paraplegic has long been controversial. Reasons have varied but primarily attaining upright posture has been for both psychological and physiological purposes.

For the young congenital paraplegic, or myelomeningocele patient, there is yet another problem. Achievement of standing balance as early as possible by the use of orthotic devices and standing frames helps either to prevent deformities or control existing deformities until the need for surgical intervention can be determined. Use of a standing orthosis tends to eliminate problems associated with non-ambulation such as the development of osteoporosis which may lead to pathological fractures of the lower limbs. Genitourinary problems also are often associated with non-ambulation. Another important reason for standing is "peer group recognition", a very important factor during this critical age of self awareness and identification.

The purpose of this paper is to describe one of the standing frames being used at the University of Miami Medical Center as a pre-Parapodium orthosis (Fig. 1). It was originally designed for the 11- to 20-month old myelomeningocele child in order to provide an orthosis that could be repaired, adjusted, and modified virtually anywhere, keeping in mind that patients who leave areas where sophisticated help is available may not be able to find it in their new location.

These statements are not in any way intended to discredit the use of the OCCC<sup>2</sup> Parapodium which we use with frequency here at the Mailman Center for Child Development. We feel that for standing orientation, the sitting feature is not needed at this early age, and therefore we have designated this design as a pre-Parapodium Orthosis. The primary needs at this time, as we see it, are ease of application, height adjustability, and the hinged knee block section to facilitate

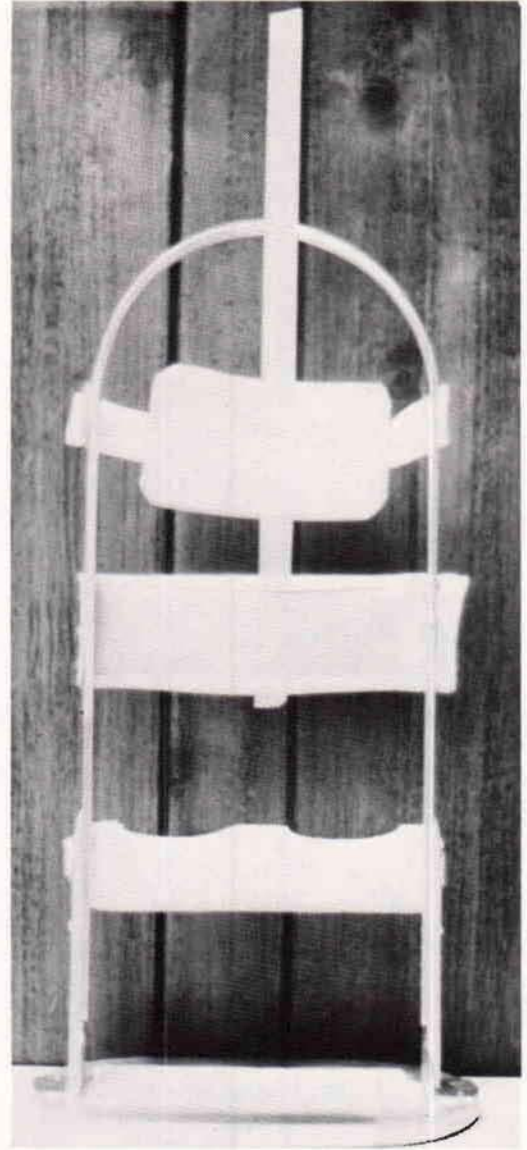


Fig. 1. The pre-Parapodium orthosis.

donning and doffing. This of course results in lesser cost.

We urge the use of "cut out" tables where the child can stand and play with their toys. Proper

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placing of the child in an area where he can observe the most activity is important so that he may feel part of the normal daily living situation.

## FABRICATION

### MEASUREMENTS

A silhouette of the child with the legs extended and shoes on is made. Diameter measurements are taken at the knee center, trochanter, and axilla. Height measurements are taken from the shoe baseline to the knee center, trochanter, axilla, and shoulder level.

### MATERIALS REQUIRED

3/16-in X 10-in. X 14-in. 2020-T4 sheet aluminum

3/4-in. X 1/4-in. 2024-T4 aluminum flat bar stock

2-in. X 4-in. aluminum angle

One 1-in. stainless steel hinge

Approximately 20-in. length of 1-1/4-in. X 1/8-in. 2024-T4 flat bar stock

One 2-in. thick Styrofoam block.

Approximately 2-ft. length of Velcro hook and pile

One 1-in. roller buckle without prong

Two 1-in. square loops

Four 1/2-in. dia. self-tapping screws

### PROCEDURES

The pattern for the base plate is the same size as the extra large Parapodium base, approximately 14-in. X 10-in., and is cut from a piece of 3/16-in. thick 2024-T4 aluminum sheet.

The adjustable metal uprights are constructed of 3/4-in. X 1/4-in. 2024-T4 flat bar stock, and shaped to form an inverted "U" (Fig. 1) that, when completed will have a diameter 3-in. greater than the width of the patient at the level of the trochanter. The length is determined by the height from the base plate to a point 1-in. below shoulder level.

Two 4-in. X 2-in. sections of angle aluminum are fastened to the base plate (Figs. 1 and 2). To

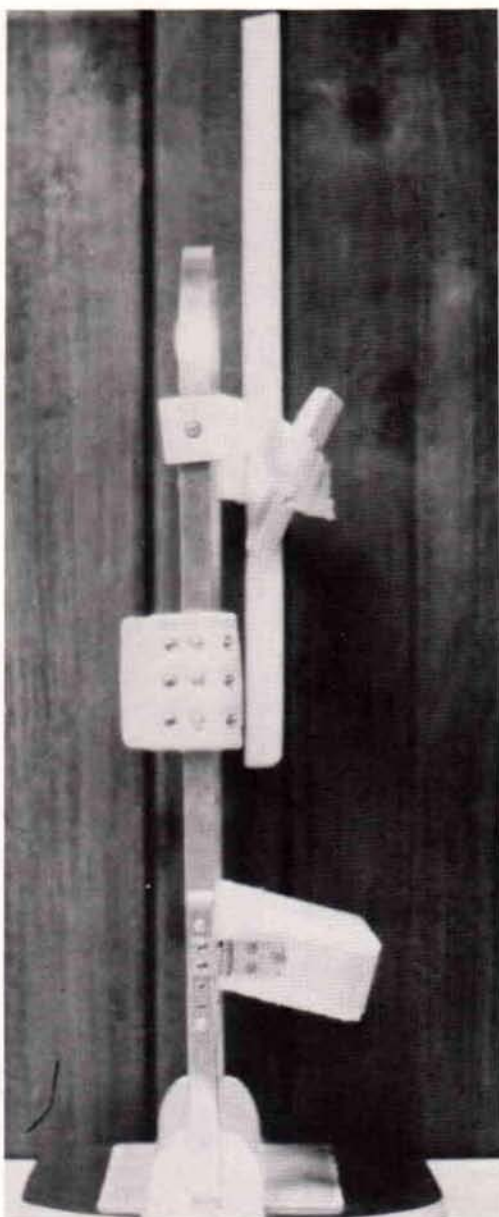


Fig. 2. Lateral view of the pre-Parapodium orthosis

these sections are fastened uprights made from 2024-T4 bar stock and in which evenly spaced holes have been drilled and tapped with #8-32 threads for adjustment. The distal third of the inverted U has been drilled with clearance holes to match those in the uprights.

Half-inch-thick neoprene rubber has been placed on the bottom surface of the base plate to provide a slip resistant surface.

A 4 to 5-in. wide buttock strap is made from Vibretta-covered elk hide. Four eyelets are placed at the edge, and the strap is located at the trochanter level and held in place by screws in the pre-drilled #8-32 holes. The length of the strap is 4-in. more than the diameter of the frame. The series of eyelets allow the application of tension required for posterior control (Fig. 2).

A 1-1/4-in. wide X 1/8-in. thick aluminum strap bent to shape is used to contain the Styrofoam knee block. It is attached laterally with a 1-in. wide stainless steel hinge and angulated approximately 10 to 15 deg. to conform with the flexed-knee balancing position. The knee block section is placed proximal to the tibial tubercle (Figs. 2 & 3).

On the superior aspect of the base plate, Velcro hook material, backed by a light piece of leather, is glued and fastened. The bottom of the shoes are provided with Velcro pile to assist in proper positioning of the feet on the base plate. Velcro instep straps are provided to control the feet upon weightbearing, and are held in place by 1/2-in. self-tapping machine screws (Fig. 4).

Various other modifications have been provided when necessary such as: 1) An adjustable member superiorly along with a wider base plate and an adjustable knee block section to accommodate for change in diameter; 2) A posterior superiorly directed bar to accommodate a head halter attachment for the hydrocephalic child.

#### ADVANTAGES

The advantages offered by this type of standing orthosis are:

1. It is adjustable
2. It is quite light in weight
3. It is durable
4. It can be used over and over on children as each user graduates to the Parapodium and other orthoses.
5. Any orthotic or prosthetic facility can make it easily.
6. The parts and materials are readily available.
7. Donning and doffing pose no problems.

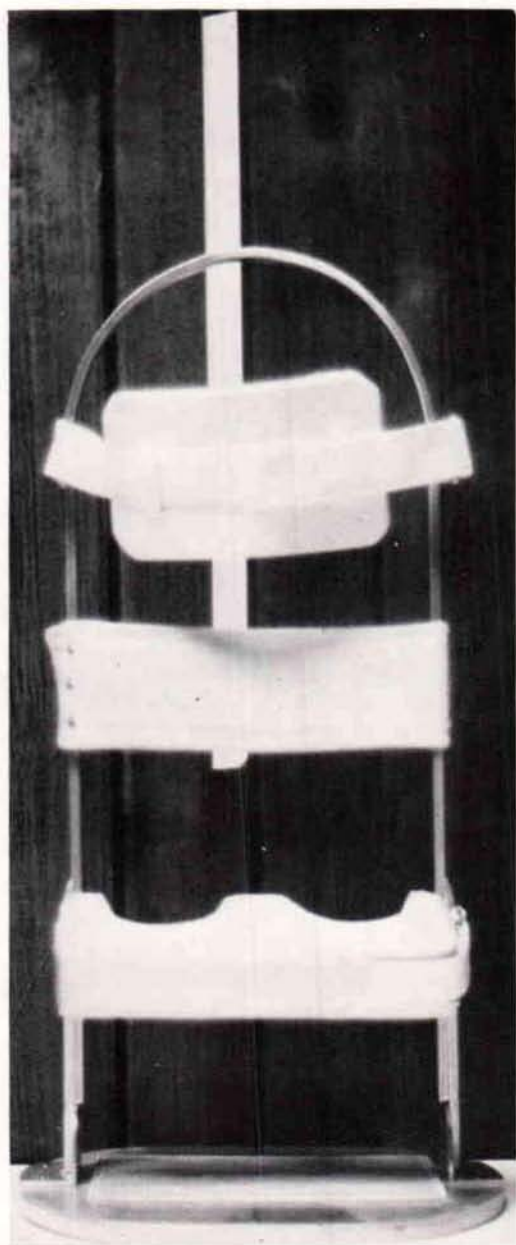


Fig. 3. The pre-Parapodium orthosis.

#### CONCLUSION

Parents are instructed initially to use the standing frame for a period of one to one-and-a-half hours BID for several days and slowly increase



Fig. 4. Velcro straps are used across the insteps to control the feet during standing.

wearing time up to three to four hours TID with care always taken to make sure that the socks are not wrinkled and shoes are not fastened tightly.

After the child is removed from the standing frame, he should be checked for any pressure sensitive areas on the feet, instep, and knee areas. We encourage the parent to gently massage this area to promote circulation and thus prevent tissue trauma.

We discourage the use of baby lotions because they tend to make the skin too soft and more subject to pressure sores. In fact, we prefer alcohol slightly diluted with water to promote toughening of the tissue.

Standing is important for these children and it should be the goal of everyone of us to provide systems to better meet these needs. We tend to take for granted our standing and ambulating capabilities. To the young paraplegic child, it is a dream come true.

#### ACKNOWLEDGEMENT

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