Wheelchair-Attachable Deltoid Aid

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The Wheelchair-Attachable Deltoid Aid is designed to be used by a patient with upper extremity weakness who requires assistance to be more independent in Activities of Daily Living skills by eliminating gravity. It is designed to provide movement in both the vertical and horizontal planes and can be placed on the wheelchair as a unilateral or bilateral device. Depending on the patient's disabilities, additional wrist support splints may be needed and one or two cuffs may be used to support the upper extremity in the device.

The device consists of an overhead rod that is attached by a standard bracket to the back upright of the wheelchair. The rod is slightly modified to accommodate three pulleys used to guide the rope that will attach to the cuff(s) to support the extremity and, at the other end, the necessary weight to counterbalance the extremity against gravity (see Figures 1 and 2).
This device is easily transported—patients can use it on the job or in the community.

Materials and Construction
A schematic drawing of the construction of the device is shown in Figure 3. An overhead suspension rod, available through many health equipment companies, is modified by cutting off approximately 20 cm of the top end of the rod and welding it to the back of the upright at the position shown in the diagram.

The measurements noted are approximate and have been used only for adult patients. Some adjustments may have to be made for smaller clients. Two pulleys are bolted or welded to the top section of the rod: one near the end and one near the upright section. A third pulley is attached at the end of the piece that has been welded to the upright. The rope is then run over the three pulleys with the cuff(s) to support the forearm of the weak extremity at one end and weights to counterbalance the upper extremity at the other end. The piece of rod welded to the upright assists in keeping the counterbalancing weights clear of the wheels of the chair.

A standard overhead suspension rod bracket, attached to the back upright of the wheelchair, is used to bolt the device in place. The winged nut may be tightened to place the rod in a specific horizontal position. At the same time, this nut need not to be tightened, allowing free horizontal movement of the rod and, thus, greater mobility for the patient since the welded piece of rod will not allow the device to slip down through the bracket.

Discussion
After comparing the device with other aids to assist a weak upper extremity (viz., balanced forearm orthoses and the standard deltoid aid), many distinct advantages were recognized. It is less expensive to construct (approximately $75.00 in materials for each device), it allows for movement in all planes, it is easily transported for use outside the home or clinic areas, and, finally, this device requires little maintenance and virtually no adjustments. The device has been used by six patients with upper extremity weakness. Their diagnoses include spinal cord injury, multiple sclerosis, and polyneuropathy. In every case the patient had some ability to move the shoulder and elbow joints, though not sufficiently against gravity, if at all, to be functional. With this device the patients could feed themselves and engage in many purposeful activities for both vocational and avocational pursuits such as typing, operating a calculator, writing, and drawing.

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