The rehabilitation of upper extremities includes improving function or compensating for disabilities by adapting the environment, providing adapted equipment, or both. For the assessment and treatment of patients with various hand injuries, I devised a simple portable device, the Handy Exerciser, from recycled materials available in Zimbabwe, a country where materials and financial resources are not as extensive as those in the Western world. The device consists of a rectangular cube made of acrylic plastic in which a cork is pushed by air generated by the squeezing of a hand pump (see Figure 1). I use it both to assess grip function and as an exerciser. Since October 1988, I have used the Handy Exerciser for approximately 1,600 patients to improve their hand function. I have used it also as an isometric exerciser for cardiac patients.

Fabrication and Construction

The materials used to construct the device were 2 cm of acrylic plastic; a rubber hand pump with a valve; two metal tubes (4 cm by 0.5 cm); cork or plasterzote (2 cm high by 4.5 cm square); a rubber tube; nuts and bolts; and a tape measure (measurements for the device are shown in Figure 2). The total length of the device is 40 cm, the base is 7 cm high, and the cube is 5 cm square and 30 cm long. A circular piece 10 cm in diameter is attached to a circular piece 8 cm in diameter with the use of three 6 cm by 2 cm pieces of plastic acrylic (see Figures 1 and 2). With these measurements, the acrylic plastic is cut and pieces are joined. I used liquid chloroform injected from a syringe as the cementing agent. Before joining the base to the cube of acrylic plastic, the cork is inserted into the cube. One metal tube is inserted into the cube, leaving 3 cm protruding. Then one end of an appropriate-sized rubber tube (I used one 1.5 m long) is attached to the outer part of the metal tube while the other end is attached to the hand pump. The upper part of the rectangular cube is closed with two pieces of acrylic plastic (8 cm by 5 cm), between which a rubber gasket is sandwiched. The other metal tube is inserted in the middle of this acrylic plastic lid, again leaving one end (3 cm) protruding.

To check that the cork in the tube moves freely, the therapist can blow air from the hand pump. Then the upper part of the rectangular cube is closed with two pieces of acrylic plastic (8 cm by 5 cm), between which a rubber gasket is sandwiched. The other metal tube is inserted in the middle of this acrylic plastic lid, again leaving one end (3 cm) protruding.

A 1-m rubber tube (the tube can be shortened or lengthened, according to the patient's hand position) is attached to the outer part of the metal tube while the other end is attached to the hand pump. The upper piece of acrylic plastic is tightened with nuts and bolts so that air does not leak out of the side of the lid. The therapist should again check the system by blowing air into the tube to see if the cork moves freely and firmly from top to bottom. The base can be made out of any material as long as it holds the rectangular cube and does not restrict the bottom rubber tube. The base is then attached to the

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rectangular cube. The tape measure is attached along the outside of the cube length to measure the distance that the cork is moved.

Use of the Device

This device is used to assess hand grip by having the patient squeeze the hand pump, pushing the cork in either direction from down to up or up to down. The time and distance that the cork is moved by pumping is recorded. It takes a nonimpaired person 9 sec to move the cork from top to bottom or vice versa; persons with hand injuries take more time, or they may not reach the full height. Hand grip is assessed before the treatment is introduced and at regular intervals throughout treatment.

The device also is used in treatment as an exercise tool. The patient squeezes the bulb of the pump, thus increasing the volume of air inside the rectangular cube, which causes the cork to move. To operate the bulb or pump, the patient needs total flexion and extension of the fingers and thumb. Persons who are only able to move the cork halfway because they lack muscle strength in the impaired hand are instructed to operate the pump with both hands. This encourages both active and passive movements of the impaired hand.

One can grade exercise by increasing or decreasing pumping time. The therapist can set a time limit for the exercise period to avoid fatigue, boredom, disappointment, and other complications such as pressure blisters, increased pain, and cardiac exertion. The pump can be positioned in any direction by increasing the length of the rubber tube.

Operation of this device is simple, but requires instruction on the function of the pump valves. When one pump is used, the other pump valve should be opened so the displaced air can pass through and not cause resistance for cork movement.

Discussion

Although squeezing an object to encourage hand function is not a new idea, I believe this compact, portable, multipurpose device has advantages over similar devices available from vendors, at least for therapists in Zimbabwe. For example, the hand pumps available from Fred Sammons and North Coast Medical supply need water and air for their function, whereas the Handy Exerciser uses only air. Because these hand pumps use water, frequent washing, filling, and coloring of the water is messy (the Handy Exerciser does not need such preparation before use). They are heavier than the Handy Exerciser,
have the added cost of using dye to color the water, and can cause errors in reading the measurements because of movement of the water or surface, whereas the Handy Exerciser’s measurements can be read at any angle. With the Handy Exerciser, if the cork is pushed from bottom to top, the measurement is read from the bottom surface of the cork coinciding with the measuring tape; if the cork is pushed from top to bottom, the measurement is read from the top surface of the cork coinciding with the measuring tape. Finally, the Handy Exerciser can be easily stabilized by a clamp on any surface, whereas the hand pumps do not have any surface to permit stabilization.

When the Handy Exerciser is compared with the air-propelled game from Adaptability Products for Living, it appears that the game cannot be used as a baseline tool because its operation is affected by vibration and external resistance from the surface. Movement or vibration, such as a deep sigh or upper extremity positioning, can cause the beads in the board to roll. The game requires partners, a large playing surface, and eye–hand coordination and can be frustrating because winning depends on the player’s strength in blowing the air. Further, the patients who play this game may not have the same hand strength to squeeze the bulb and blow the air on the bead as they wish. Thus, winning is dependent on the patient’s quick and easy hand movements, hand strength, and volume of air expelled through the nostril of the bulb.

Finally, for therapists in Zimbabwe, ordering developmental equipment from vendors overseas is often more costly than constructing one’s own equipment, because our human labor is less expensive than that in the Western world.

In recent times, constant challenges in hand therapy and the desire to restore full or nearly full use of the client’s affected hand has increased the quest for understanding the hand’s complexity through various evaluation tools and treatment techniques.

When I was working in India, Zambia, and Zimbabwe I experienced a severe shortage of appropriate evaluation and treatment tools. This need forced me to find a new way of evaluating and treating patients by making tools from the materials available to me. The Handy Exerciser is one of the many tools that I have tried to use for hand therapy, and it has proven to be effective to this end. Through publication of the Handy Exerciser’s method of use and construction, I share my achievements with other therapists who constantly search for effective hand rehabilitation tools. I assume that by introducing the Handy Exerciser, I have attempted to enhance the area of hand therapy and have revealed occupational therapy development in the third world. ▲

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