Severely physically handicapped children stand to reap many benefits from the advances made in technology in the past few decades. Many, however, have few reliably controlled body motions that can be used to operate technical aids. These children must be well positioned in

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Figure 1 L using light sensor to operate Proscan

Figure 2 D using Winsford Feeder while arms are restrained under tray

Figure 3 S communicating with an Etran System while arms are restrained
a dynamic, stable seating system to use even their limited and minute motor control capabilities to efficiently operate feeders, communication systems, mobility aids, or powered wheelchairs.

To enhance the motor abilities of children with athetoid cerebral palsy, their arms are restrained under their wheelchair trays during specific periods of time. During these time periods, not only are their upper trunks and heads more stable, but the athetoid motions of their arms are also prevented from inhibiting functional activities. Before receiving their customized trays, children inadvertently dislodged headsticks and knocked plates off their trays. Therapists often reverted to strapping the children's arms during these activities. When given the option, most of the children request that their arms be placed under their trays.

(Experience with three children with athetoid cerebral palsy is presented to illustrate the advantages of restraining their arms under their wheelchair trays during specific activities requiring optimum head control.)

(A) L is a 12-year-old girl with tension athetosis. She is severely motor impaired, has no functional use of her hands, and her speech is unintelligible. She is seated in a Modular Plastic Insert (MPI) system with a custom-designed tray modification used to restrain her arms (1). When her arms are not restrained under the tray, their athetoid movements dislodge the head-piece, which results in injuries to her hands. She loses all control in her trunk and head and is unable to operate any technical aid.

Her tray was vacuum-formed from .156 cm (5/16-in) ABS plastic over a particle board mold. To duplicate this design, one needs access to a vacuum-forming machine that can accommodate a 120 x 120 cm (4 x 4 ft) sheet of plastic. The mold used for L can accommodate children ages 7 to 15 years. The tray and the hardware necessary to mount the tray to adjustable-height wheelchair arms can be purchased from the University of Tennessee Rehabilitation Engineering Center's Service Program (2). In this seating system, L is able to direct a light sensor mounted on her head and access the Proscan (3) at an average rate of 34 characters per minute (Figure 1).

(B) Eleven-year-old D uses an MPI in an Everest and Jennings Junior 13 wheelchair and has a Winsford Feeder (4). He does not have sufficient hand control to operate the rocker switch, one of the switching mechanisms available to operate the feeder, and, therefore, uses the chin switch. To obtain sufficient upper trunk stability and to keep his arms from hitting the feeder, he places his arms under his tray (which required no modification) during feeding times. D can now feed himself efficiently within the 20 minutes allocated for school lunches (Figure 2).

(C) S, a 7-year-old, uses an MPI communication system mounted on her tray. To keep her upper trunk stable so that the receiver can clearly determine which symbol she is looking at, her arms are restrained under a tray that was modified by adding foam padding. A piece of Ethafoam with sculptured arm recesses was attached to her tray cutout. The outline of the tray cutout was traced on a 5-cm (2-inch) piece of Ethafoam (5), which was then cut with a sharp knife to conform to the cutout. To make the arm recesses, a draftsman's lead was used to obtain the outline of S's chest and restrained arms 5-cm (2-inch) proximal to her elbows (6). The pattern was traced on the Ethafoam and cut. The block of foam was pop-riveted to the cutout of the tray. A layer of moleskin on the edge next to the skin prevents irritation to bare arms. Using adjustable-height wheelchair arms, the tray was then mounted 5 cm (2 inches) above her elbows. S communicates at an average speed of six symbols per minute. The arm restraint tray is also used during feeding times. The extra stability enables her to be fed a randomly selected school lunch in 17 minutes, whereas with unrestrained arms she required 25 minutes or more (Figure 3).

Conclusion

Multiply-handicapped children with cerebral palsy who have no functional use of their hands gain added upper trunk and head stability if their arms are restrained for certain activities. In particular, technical aids such as communication devices, mobility aids, and feeders can be operated more efficiently when the subjects' arms are restrained. The restraining tray can either be custom designed, as with child A; an unmodified commercial design, as with child B; or a modified commercial design, as with child C.

REFERENCES

1. MPI: Modular Plastic Insert, Medical Equipment Distributors, Inc., 1701 S. First Avenue, Maywood, IL 60153
2. University of Tennessee Center for the Health Sciences-Rehabilitation Engineering Center, Service Program, 682 Court, Memphis, TN 38106
3. Proscan, Prentke-Romich Company, Route 2 Box 191, Shreve, OH 44676
4. Winsford Feeder, Winsford Products, 179 Harbortown Road, Pennington, NJ 08534.
5. Ethafoam can be purchased from Floral Supply houses at approximately $55.00 for a 2 x 48 x .08 inch sheet (December 1981)
6. Draftsman Leads can be purchased at Drafting Supply Houses