This case report presents Pam, a young woman with multiple disabilities whose life has been enriched by the acquisition of powered leisure and communication aids. Pam resides in a state institution for persons with mental retardation where occupational therapists have designed and fabricated powered devices that have made her life more enjoyable and fulfilled. The development of these aids and the clinical reasoning process used by the therapists is described.

Client Information

Pam is a 25-year-old woman who has been diagnosed with spastic quadriplegic cerebral palsy that has resulted over the years in severe scoliosis, neck hyperextension, and multiple contractures in her upper and lower extremities. She also has a seizure disorder that is currently controlled with medication. Pam has had pneumonia on and off since 1983, and she had a total laryngectomy in 1984 and a tracheostomy in 1989. She uses a gastrostomy tube for feeding and a mist machine to relieve respiratory problems. Because of her tenuous medical condition, she resides on the medical unit of a state-operated institution for persons with mental retardation.

Pam presently spends most of her day lying positioned in several postures on a gurney. She has significant fluctuating muscle tone throughout her body and frequently demonstrates random athetoid movements, particularly in her upper extremities. These motor limitations, together with deformities, have prevented her from developing most fine and gross motor skills, leaving her dependent in all activities of daily living. She has minimal voluntary movement.

Pam had difficulty breathing at birth, and spasticity on her left side was noted immediately. At 10 months of age, she began an intensive program of movement patterning, which she received for 4 years. The only developmental milestone noted was the ability to smile; she never achieved other milestones such as supporting her head, rolling over, or sitting up. Her grandparents took care of her until 1971, when at 7 years of age, she was admitted to a state school for persons with mental retardation. She has remained there until the present. Various members of her family visit her regularly.

During the course of her stay at the facility, Pam has participated in educational and therapeutic programs to the degree that she was able given her physical limitations. She has received physical, occupational, speech, and music therapy, and she has had a special tutor. During an average week, she currently participates in a variety of adapted activities. She engages in an arts-and-crafts program and is seen by a music therapist. She participates in an activities of
daily living program of dressing, grooming, and oral hygiene by making choices using a picture communication book. She works on a variety of communication objectives with a speech therapist several times a week. In occupational therapy, she works on a motor training program focusing on switch usage. Pam is improving her listening comprehension using books and audiotapes, and her orientation using a calendar and other media. Her favorite pastimes include interacting with other people, listening to music, painting with an adapted paintbrush, choosing the clothes and perfume she will wear, attending parties, and doing schoolwork.

Despite her physical limitations, Pam is cognitively alert and shows great awareness and understanding of daily events and the interactions that occur around her. She demonstrates a sense of humor and enjoys being with people and participating in new learning and leisure experiences. She is highly motivated to learn. Cognitive testing has been difficult, but Pam appears to have listening comprehension skills at about a second-grade level.

Although she is completely nonverbal, Pam can communicate using facial expression as well as eye gaze and eye movement. Extensive training with a speech therapist over the last few years has enabled her to develop an ever-increasing picture word vocabulary. She currently recognizes approximately 250 pictures in a specially designed communication book. Many of the staff members are being trained to use the book with Pam and to recognize how she uses eye gaze to identify a desired picture.

In the past, Pam has received occupational therapy for positioning and feeding (although she now has a gastrostomy tube) and physical therapy for range of motion. She participated in an unsuccessful attempt to use a body jacket to ease the symptoms of scoliosis, and she had neck-strengthening exercises to counteract hyperextension.

Evaluation for Switch Control

In 1987, when Pam was 22 years old, she was referred to occupational therapy for an evaluation to identify a voluntary movement she could use to control a switch. Although previous attempts to isolate a consistent and reliable movement that she could use to activate a switch had been unsuccessful, another attempt was made because the occupational therapist believed that new technology was available that might be helpful. At this time, Pam’s communication was limited to yes/no responses using eye movement and to a 16-picture communication board. She had no physical control of any objects in her environment.

It had become increasingly clear to staff and family members that Pam had excellent comprehension and understanding of events and situations that occurred within her environment. Her motivation to gain increased control over her environment was apparent, and she appeared to have the cognitive skills necessary to access a variety of augmentative communication devices, including computers. The eventual goal of occupational therapy was to enable her to use a switch to operate adapted devices that would facilitate communication, leisure skills, and environmental control.

A few months before this referral, an expensive, highly sensitive switch, the Prentke Romich Piezo Electric Switch (P-Switch),1 had been acquired for Pam to try. It operates by detecting muscular movement and translating that movement into a switch closure that can control various devices. The occupational therapist positioned the P-Switch and its sensors over various muscles in Pam’s body but, despite repeated trials, spasticity and extreme fluctuation of tone prevented the identification of any reliable voluntary movement. The P-Switch was therefore deemed inappropriate for her at that time.

However, over a period of 3 months, these trials with the P-Switch, together with the occupational therapist’s observations of Pam’s movement patterns and information and feedback from her direct care staff, revealed that Pam was able to initiate some controlled movement in both lower extremities. In particular, she was able to actively abduct and externally rotate her right hip when her right knee was flexed. With proper positioning in a side-lying posture, active extension of her right knee to about 90° allowed her to abduct her right hip and leg. Although this lifting movement was minimal, it was self-initiated and voluntary and did not appear to be greatly affected by fluctuating tone and spasticity.

With this specific movement in mind, an apparatus was designed and fabricated that suspended a tape switch over the gurney Pam lies on at her day program. When she abducted her right leg, she depressed the switch with the side of her leg, which then activated a device (see Figure 1). The entire stainless steel apparatus was designed for durability and adjustability. It has two movable joints to allow correct positioning of the switch, and the base is mounted to the side of the gurney. It was designed by the occupational therapist, and the construction and welding were completed in the facility’s Therapeutic Equipment Center. The tape switch is secured to the bottom surface of the extended bar with a touch fastener (see Figure 1). It was fabricated from materials purchased from the Tapeswitch Corporation.2

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1 Available from Prentke Romich Company, 1022 Heyl Road, Wooster, OH 44691.
2 Available from Tapeswitch Corporation, 100 Schmitt Boulevard, Farmingdale, NY 11735.

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The Evaluation and Treatment Process

The initial goal for the switch training program was to teach Pam to activate the switch in order to turn on a sound chimes box within a targeted amount of time. The therapist required Pam to activate the switch on the count of 5 and used a stopwatch to see how quickly she activated it after the verbal cue. The time parameter for switch activation was 3 sec, because many augmentative devices and computer programs she might use have scanning sequences with a delay of up to 3 sec. The occupational therapist worked with Pam once a week for approximately a half hour, depending on her tolerance, and Pam's tutor carried out the training program two additional times per week.

In the first 6 months, Pam gradually learned to listen for and anticipate hearing the number 5, so that she could activate the chimes as close to this targeted number as possible. She learned to differentiate between the act of depressing the switch on the count of 5 and depressing it after she heard the number 5.

Pam gained motor control of her right leg gradually. Initially, the therapist physically guided her leg through the desired movement, so that Pam could better isolate and kinesthetically feel the movement. Having a starting position was important, because it allowed her to have a sense of initiation and completion for the movement.

Consistency of movement was often difficult due to changes in muscle tone caused by stress, excitement at being able to use the switch, and changes in medication. But the therapist's growing understanding of ways to encourage and help Pam to relax helped her overcome these obstacles so that her movements gradually became more consistent. After 9 months, Pam was able to activate the switch with verbal cues in a consistent and reliable manner. The therapist then determined that she should progress to a new activity, which would involve visual target cues.

A large blank-faced, switch-operated, clocklike device was fabricated and hooked up to the chime box. Two pictures from Pam's communication book were fastened to the face of the clock. The therapist and tutor controlled the battery-operated clock hand, which rotated at 2 rpm. Pam was required to activate the chimes, using the switch, when the hand reached the requested picture. As Pam's understanding of the activity grew, two more pictures were added to the clock face. Stories and games were invented to match the different pictures (e.g., Pam was told a particular story when she activated the chimes at the requested picture).

When Pam's ability to coordinate her eye and leg movements was consistent and reliable, the switch was further adapted and made to function in an on/off manner. This allowed Pam to stop and start the hand of the clock independently, rather than have the therapist control the hand. Various activities, such as Lotto and memory games, were introduced. The use of an on/off switch required increased motor control because, after activating the switch, Pam had to pull her leg away quickly so as not to accidentally depress the switch again and stop the clock hand. Pam's motivation and ability to persevere were high throughout this process, and she made steady progress, although it was delayed at times due to respiratory and other medical problems that required occasional and sometimes lengthy hospitalizations.

Pam was excited when she realized that she was able to turn something on and off independently. Three battery-operated games were adapted for her during the training period to enable her to play independently while practicing using the switch and increasing motor control (see Figure 2).

The switch itself has changed over time. As mentioned, the initial switch was a highly sensitive tape

![Figure 2. Two of Pam's favorite leisure activities, singing bird and swimming fish, which are activated by a switch. Note. Illustration by Robert Lee.](image)
switch mounted to a bar on Pam's gurney. Because the initial switch broke frequently, a less-pressure-sensitive tape switch was successfully introduced once Pam's muscle control had increased. Then unexpectedly, about 1½ years into the program, her medical condition changed and she became increasingly uncomfortable in the side-lying position. Because she had to lie more frequently in a supine position, she could no longer use the suspended switch.

After initial concern that a second switch location might not be identified, the therapist noticed that Pam could slide her left leg to a small degree over the surface of the gurney. She identified a second switch—a large plate switch—that Pam could depress and activate with her left foot (see Figure 3). Pam is presently learning to use this new switch in a more consistent manner, and is making progress. Her therapist believes that Pam's increased understanding

Figure 3. Sliding left leg over to depress large plate switch.

of the pleasure that can be derived from environmental control, together with her new understanding of the need for motor control to activate a switch, were instrumental in her exhibiting this new voluntary movement.

Pam is now learning to use the plate switch to call for assistance and is learning to use a linear scanning communication device. This device, the Zygo Model 16 Communication Board, features 16 different display areas that can be filled with photographs or pictures. Each display area has a bright signal light and four of them have an audible alarm. Activation of the switch will stop the signal light on the desired picture. Once Pam has mastered this, she may be able to progress to using a computer for further communication, education, and leisure activities.

Summary

The ability to operate switches in order to communicate more effectively and to control leisure activities has greatly enriched Pam's life. The switches have opened up a world of entertainment that she can enjoy independently. Both her desire and her ability to explore and master her environment have increased—a major thrust of functional independence so important in occupational therapy. 

4 Available from Zygo Industries, Inc., PO Box 1008, Portland, OR 97207-1008.

Editor's Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.

1 Available from AbleNet AccessAbility, Inc., 1081 10th Avenue, SE, Minneapolis, MN 55414. (Listed as "Big Red" in the catalog.)