Children with neuromuscular disorders often have abnormal muscle tone, movement patterns, and limb position. They may hold the affected arm in a position of shoulder internal rotation, forearm pronation, fisted hand, and thumb in palm. The child's attempts to move the arm may increase spasticity and exaggerate this position, making use of the extremity difficult or impossible. Static splinting with thermoplastics may improve positioning, but often limits function and sensation. The challenge is to help the child position the arm more functionally while continuing to allow him or her to move and experience the sensory feedback of correct movement. If normal movements can be facilitated, they will actively inhibit the abnormal movement patterns (Bobath & Bobath, 1972; Trombly & Scott, 1977). Thus the child can learn to inhibit his or her own abnormal patterns by moving in more normal ways. An early intervention may help to minimize the development of a distorted body image that can accompany a dysfunctional limb.

One way to reduce upper extremity spasticity is to make use of one of the "key points of control" (Bobath & Bobath, 1978, p. 164) by positioning the thumb in abduction and the forearm in supination. The Thumb Abduction Supinator Splint (TASS) was developed at Gillette Children's Hospital in 1986 to approximate this position. The TASS is made from neoprene, a soft, stretchable, nylon-covered rubberized foam used most commonly for scuba divers' wetsuits. It uses a thumb abduction sleeve (Siegling & Click, 1984) as a base from which to anchor a neoprene strap that gently pulls the forearm into a position midway between pronation and supination. The splinted limb is then positioned to function, yet can move within a prescribed range and be included in bilateral activities.

Materials
To make the TASS, you will need 1/4 in. neoprene (available from scuba outlet centers), hook-and-loop fastener material, and a sewing machine with a No. 90 ballpoint needle.

Construction
First, make a pattern for the thumb abduction sleeve, using Figures 1 and 2 as a guide. Note the following:

- A-A1 covers half of the thumb web space.
- A1-B1 falls just below the thumb IP joint unless the entire thumb requires support. Allow

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The thumb abduction sleeve was designed in 1983 by Debbie Hastic-Sorenson and Michelle Sellars-Jones, San Diego County Department of Health Services, Children's Services, Vista, California.
for one-half circumference of the thumb plus ¼ in. seam allowance along A–A1 and B–B1.
• A–C falls just below the distal palmar crease.
• B–D falls just above the wrist joint.
• Length of dorsal portion of thumb sleeve is equal to the width of the hand. Add an additional 1 to 2 inches for the palmar portion of the thumb sleeve.

Then, measure for the supinator strap (see Figure 3) as follows:

Width: Measure dorsal width at wrist and divide in half (A).
Length: 1. Measure length of forearm (B).
2. Add measured circumference of midforearm (C).
3. Add circumference of arm just proximal to elbow plus 2 to 3 inches for overlap of cuff (D).

After you have made the pattern and measured for the supinator strap, proceed as follows:

1. Using pattern (see Figure 1) that has been adjusted for your patient, cut two pieces of neoprene.
2. With right sides together, sew along A–A1 and B–B1. Trim seam, turn right side out.

3. Apply splint. Adjust volar and dorsal portions of the splint to achieve desired amount of thumb abduction and cut excess accordingly (dorsal portion overlaps volar portion by 1 in. for hook and loop closure).
4. Sew hook-and-loop fastener onto thumb sleeve, loop side down on dorsal portion, hook side up on volar portion. Fit should be snug but not constricting.
5. Using measurements as determined above, cut out supinator strap from remaining neoprene.
6. Sew supinator strap to dorsum of thumb sleeve diagonally, as shown in Figure 2.
7. Apply splint, stretching supinator strap while pulling it diagonally around volar aspect of forearm toward lateral epicondyle of elbow. Stabilize strap at elbow while allowing the remaining "cuff" section to return to resting length before wrapping it just above the elbow. Mark for 2 in. hook-and-loop closure and cut off any excess strap. The cuff should not be con-
stricting. There should be enough space to slip one to two fingers between cuff and arm. (The proper application of the dynamic forces of the TASS is essential in assuring effectiveness of the splint.)

8. Sew hook-and-loop fastener on supinator strap at point where it is wrapped above elbow (see Figure 2).

Wear and Care of the TASS

Neoprene’s insulating properties can cause perspiration and possible skin breakdown. Therefore, a wearing schedule of 3 to 4 hours on and 30 minutes to 1 hour off is recommended to allow the skin to be cleansed and aired. For sensitive skin, a stockinette can be worn under the splint. The splint should be hand- or machine-washed in mild soap and air-dried at least twice a week. It is helpful to make two splints so that one can be in use while the other is being washed. Replacement splints are usually needed for the growing active child after 6 months to 1 year of daily wear.

Before fitting a child with the TASS we recommend fabricating an adult-sized version to demonstrate application of the splint’s dynamic forces to the parent or caretaker. Figures 4 and 5 show the TASS in position.

Selection of Candidates

The effectiveness of the TASS is determined by the appropriate selection of candidates, good fit, correct application, and consistent wearing time. At Gillette Children’s Hospital and Milwaukee Children’s Hospital, we have made this splint for over 50 children with neuromuscular disorders, due primarily to cerebral palsy or head injury. The TASS has been most useful for the child whose upper extremity has mild to moderate spasticity but no severe contractures, and is in a pattern of forearm pronation, fisted hand, and thumb in palm. The splint has been especially useful in helping young hemiplegic children learn early to incorporate the impaired arm in bilateral activities. We have successfully splinted children as young as 10 to 12 months old (a child with normal muscle tone will reach for objects with the forearm in a position between pronation and supination and thumb out of the palm by 6 to 7 months [Erhardt, 1982]). In the school-age and older child, good sensation and cognitive potential as well as motivation to increase arm use will improve results.

Improvements seen in function after the TASS has been applied result from decreased spasticity and appropriate forearm positioning for bilateral activities (e.g., playing catch with a large beach ball, swinging on a playground swing, pushing a stroller or walker) and from improved fine motor ability due to stabilization of the thumb for lateral or fingertip pinch.

Summary

Thermoplastics are useful for many types of splints, but most splints made from them position the hand statically and have the disadvantage of limiting the sensory feedback that occurs during normal use and movement. Neoprene is an alternative to thermoplastics when dynamic mobility in splinting is the goal. Neoprene is soft, stretchable, lightweight, durable, nontoxic, machine-washable, and has a good memory.

The TASS uses the Bobath’s key point of forearm supination and thumb abduction to position the upper extremity more functionally without the patient having to use effort. Thus sensory feedback can occur while the limb is moving within a prescribed range.
The TASS can be used as an extra "hand" during the occupational therapy treatment session, or it can be applied immediately after treatment to continue to facilitate functional positioning of the limb.

References


Related Readings
