

Static/Dynamic

POSTURE

How can two opposing forces be incorporated into a single design? Head control requires both static and dynamic control. It remains one of the profound problems facing seating teams. Good head and visual control begins with proper positioning from below the shoulders to the toes.

Story and photos by John Doherty, OTR/L, and Michelle Robdau, MSPT

We have been challenged to provide static/dynamic head control for a young woman who was referred to us at New Hampshire Assistive Technology Center. This is an ongoing challenge and with this presentation we hope to encourage feedback from readers of *TeamRehab Report*

Sara is an 18-year-old who has an active social life in and out of school. At the age of 11, she nearly drowned, which resulted in an acquired brain injury secondary to anoxia. She has two younger sisters, a twin brother and her parents, Ellen and Royal Edgerly, who are supportive and act as strong advocates for her. She lives with her family in Rochester, N.H., in an older home that the family has



Sara's head position impacts her functional ability to access her environment and, consequently, her educational goals.

communication equipment. To access these technologies, she uses her bilateral index finger to activate single switches. She has also tried a blink switch. In addition,

and alternative communication device; and to be able to relate to the world socially, emotionally and psychologically.

Sara owns a power wheelchair that she operates through scanning using a Microlite switch, but switch use has been inconsistent and further experimentation is needed to determine a more consistent method of control.

In her seating system, Sara had poor back support and did not make contact with the back. She leaned to her left, slid forward in the wheelchair, and had unequal weight distribution through her hip and pelvis, with more weight on the right. Her head and neck were flexed with her chin close to her chest. This was accompanied by left

Sara's goals: to improve her posture while seated and to improve her head position and visual field

remodeled for accessibility. She has a team of nursing care providers who assist her at home and school. For family outings, Sarah has an accessible van driven by her parents in which she travels comfortably in her wheelchair.

Sara communicates using a variety of strategies including eye gaze, facial expression, vocalization and crying. She is able to respond to yes/no questions consistently through eye gaze. She also uses dedicated and computer-based com-

power mobility and an augmentative and alternative commu

eye gaze technology is being explored. Her communication is most successful when the listener is familiar with Sara and her routine.

Sara came to NHATECH with the following goals: to improve her posture while seated and to improve her head position and visual field in order to access her environment by operating switches for power mobility and an augmentative

lateral flexion and rotation. She had elevated shoulders and her elbows and wrists had contractures with resulting tenodesis with finger extension. As a result of overall postural and muscular imbalances, Sara's head position impacts her functional ability to access her environment and consequently, her educational goals.

A mat evaluation confirmed a strong

Head Control:

SSIBLE?

flexor spasticity pattern primarily of her upper extremities, head and neck. Spinal alignment included a right lumbar scoliosis with Harrington Rod fixation and kyphosis. She presented a pelvic obliquity with the high side on her left and the left side of her pelvis forward of her right, and limited hip motion.

After the mat evaluation, multiple simulation sessions were necessary to accomplish the goals of improving posture, appearance and head control. During the simulation sessions a seating system was devised. However, Sarah's head control needed further improvement beyond what her Whitmyer headrest offered. She had tried several commercially available collars, including the Headmaster Collar from Symmetric Designs, a cervical soft collar and a Hensigner collar from Danmar. She found them to be uncomfortable and they did not provide sufficient postural support that would hold up to her necks flexor tone.

NHATECH made a prototype of a cervical orthosis using a chin-



One of the options Sara tried was the Symmetric Designs Canadian collar.

casting, fitting and alterations.

Following the fitting sessions, a wearing schedule was set up whereby Sara would wear the orthosis at home with her mother's supervision and during a motivating activity, e.g., watching her favorite television show. Sara began wearing the orthosis for 30 minutes once a day. Ellen was instructed to observe Sarah for discomfort and too much pressure.

One week later, Sara returned to NHATECH for a wheelchair fitting appointment. Ellen told us that the cervical collar did not hold up under Sara's strong flexor tone and needed to be realigned.

After Sara returned to the orthotist for re-fitting, Sara and her team decided that the collar was not accomplishing the original goals of improving neck posture. Sara resisted wearing the collar because it was not cosmetically appealing (the chin piece encompassed her lower face and jaw). When she resisted, she used her muscle tone to flex her neck forward into the chin piece. The rigidity of the chin piece caused discomfort, which



To access her dedicated and computer-based communication equipment, Sara uses her index fingers and single switches.

ture while being comfortable and appealing. The flexible properties of the collar allowed Sara some neck flexion during tonal episodes, while continuing to provide support during relaxation. After a one-month trial, it was found that the Canadian collar did not provide enough stability because there were insufficient vertical supports which caused the collar to collapse. It provided dynamic support, but it lacked stability.

The orthotist was consulted again to explore incorporating the dynamic features of the Canadian collar with the static holding properties of the custom orthosis. The visit with the orthotist included modifying

in order to access her environment by operating switches for communication device; and to be able to relate to the world socially, emotionally and psychologically.

control joystick harness. To design a finished orthosis, we realized that the expertise of an orthotist for technical support and supplies was required to remain cost effective. The orthotist assisted the NHATECH therapists with a design that would create neutral neck alignment and hold up to Sara's strong flexor tone. Three sessions with the orthotist and the NHATECH team included discussion of design,

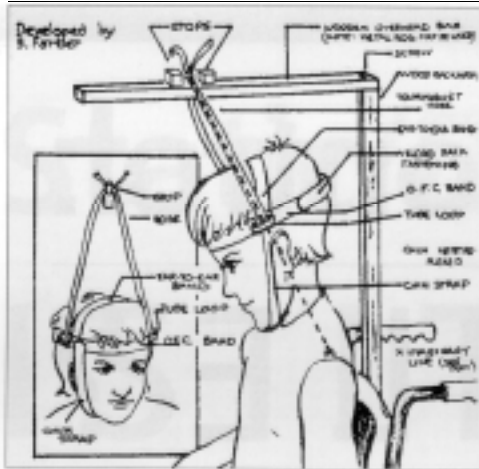
increased tone and resistance.

It was obvious we needed to redesign the collar so that it would be more appealing and comfortable for Sara. The team decided to experiment with a different collar before contacting the orthotist. The Symmetric Designs Canadian collar was tried. It demonstrated dynamic support as opposed to rigid static support and had the potential for improving head pos-

the custom cervical orthosis to be less rigid. Spring steel was used to support the chin piece and it was reduced in size. But attempting to provide better fit and comfort compromised the dynamic components. At this point, the team decided that Sara should wear the orthosis for a trial period before further modifying it. So far Sara's mother has said Sara is still uncomfortable wearing the custom orthosis.



The custom orthosis designed for her would create neutral neck alignment and hold up to her strong flexor tone.



The occupational therapy department at Shriners' Hospital in Springfield, Mass., provided the sketch for the DHS System (left). Using the system, Sara said she has more freedom of movement.



At the same time, the NHATECH team and the orthotist are modifying the Canadian collar by adding more vertical struts and adjusting the size for more stability. The end result will be to discover if

DHS is that the head sling is designed to provide a quick stretch to the neck extensor (and the sternocleidomastoid muscles) when the user's head falls either forward or to the side. If the chin is tucked properly when wearing the device, the head should not fall backwards.

indicated cervical traction occurs at 25 to 45 pounds. By placing a scale on the DHS while Sara was using it, we found that only 9.5 pounds of force was being applied, confirming that cervical traction was not occurring.

The NHATECH team modified the original head support design to make it easier to set up and remove. The later design used a commercially available cervical traction harness. Sara has reported that she was more comfortable in the original harness, and it was switched back.

Sara will continue to wear the DHS and will hopefully continue to tolerate it well. The plan is for her to wear it one to two times a day for one or two hours, preferably during therapy times and during functional activities. We are trying to work with the home team and the school team to see if it is possible to integrate it into therapy times at school and functional activities at home.

When modifications to the Symmetric Designs Canadian collar have been completed, Sara will wear it along with her Whitmyer headrest to maintain improved range of motion and to provide her with postural support for improved visual and postural function.

The NHATECH team will monitor Sara's range of motion, comfort and posture. The cervical orthosis will continue to be improved. The team will continue to explore the possibilities for providing static/dynamic head and neck support.

If you have comments you would like to share with us regarding solutions to Sarah's needs, please contact us.

John Doherty and Michelle Robdau are clinicians at NHATECH, 5 Right Way Path, Laconia, NH 03246; 603/528-3060; fax:603/524-0702; e-mail: jdoher-ty@cyberportal.net or mrobdau@

Costs for Sara's Equipment, Not Including Clinician's Time

Power wheelchair seating system modifications	\$3,500
Estimate for custom cervical orthosis, including follow-up appointments	\$1,200

Funded by private insurance, Medicaid and Community Care Waiver

this is the appropriate collar for Sara or if the design can be made into a custom collar. In the interim, Sam wears a soft cervical collar for additional neck support while in her wheelchair.

Another approach to better head and neck support for Sara came from an idea her mother brought to the team. Ellen received a diagram of dynamic head support from the occupational therapy department at Shriners' Hospital in Springfield, Mass. The design promotes cervical motion in all planes. This concept would help Sara reduce her muscle tone while actively strengthening her neck musculature. The team at NHATECH discussed the concept and we felt it might work with Sara. We began making a prototype of the DHS that would work when mounted to her current seating system.

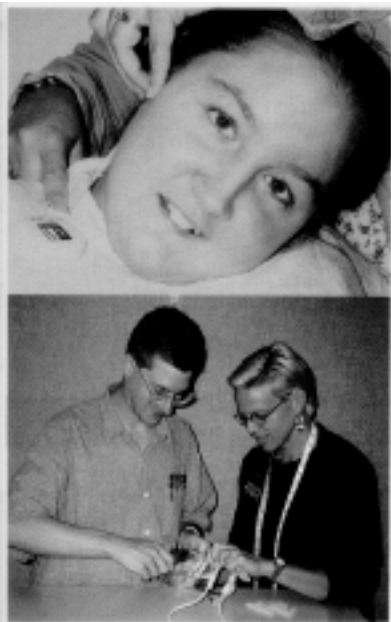
The principle of the

We set up the DHS on Sara's wheelchair with parameters for skin check and a wearing schedule. The initial plan was for Sara to use it at home under parental supervision. One month was used as a trial to determine fit and comfort.

The feedback from Sara, Ellen and Sara's team of care providers indicated that Sarah enjoys wearing the DHS because of the freedom of movement. Caregivers also observed that Sara was able to maintain her head in a more upright posture in the Whitmyer headrest. She has noticeable decreased lateral cervical flexion to the left and is resistant to the use of external supports. Before use of the DHS, Sara had a Whitmyer headrest with Soft 1 (large) sub-occipital pads, an occipital pad as a temporal pad to check lateral flexion and a horizontal head strap. Since the use of the DHS, she now uses a small temporal pad for lateral support. This smaller pad has made it possible to see more of Sara, which pleases her and makes her more comfortable with external support.

To prove the DHS was providing proper alignment but not cervical traction, we suggested that Sara see her orthopedic physician. Radiographs were taken of her cervical spine while wearing the DHS. They showed good postural alignment and no cervical traction. The orthopedic physician said that since her posture looked good, Sara should continue to wear the DHS at her comfort level.

Despite this report, the NHATECH team wanted more evidence that no cervical traction was occurring. Our research



After wearing the DHS, measurement of lateral cervical flexion (top) has decreased noticeably. The authors, John Doherty, OTR/L, and Michelle Robdau, MSPT.