A Positioning Seat for the Neonate and Infant With High Tone

(equipment design, positioning; pediatrics; positioning; muscle spasticity)

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Positioning and seating are important for premature and young infants with tonal problems. Positioning with pillows and sandbags, the use of special handling techniques (Bobath’s neural developmental treatment), as well as other specialized approaches, have not proved satisfactory in reducing tone or spasticity in these infants. We developed an adaptive seat designed to reduce extensor tone through proper positioning. This seat has also been helpful in diminishing agitation. Without these benefits, infants are often immobilized in extension and cannot actively explore their environments. Diminution in agitation has also been important in increasing interaction with nurses.

We developed an adaptive seat designed to reduce extensor tone through proper positioning, that is, with hips flexed to a greater than 90° angle, hips abducted to a greater than 20° angle, body and head well supported, and shoulders well protracted (1–3) (see Figure 1). Because it promotes normal posture while reducing extensor tone, the positioning seat enables the high-toned infant to have (a) greater awareness of external stimuli and (b) more normal control over the body, with less effort. This enhances development because, as more normal neural input is facilitated, more motor neural output can be produced (4, 5). Other benefits derived from the use of this device include marked changes in infant behavior, ranging from significant agitation to a more normal level of calmness; more rapid acquisition of developmental skills such as head control, ocular control, and upper and lower extremity control; improved temperature regulation; and a reduction in the number of nursing care problems and range-of-motion exercises required each day.

Selection of Population

The use of this seat is determined more by size than age. With appropriate adjustments, it usually fits infants weighing from 1 to 9 kg (2.2 to 20 lb) or approximately 28 weeks' gestation to a "normal" 6-month size. Infants who are small for their age can use this seat for several additional months.

In the intensive care nursery (ICN) of Sinai Hospital of Baltimore, a number of infants with high tone resulting from various medical problems have been placed in the positioning seat. Diagnoses of their problems include grade III or IV cranial hemorrhages, anencephaly, microcephaly, severe birth anoxia, asphyxia, high risk, multiple birth anomalies, and dystonia of undetermined etiology.

There are two criteria for using this seat: (a) medical stability (resolution of any life-threatening situation) and (b) the presence of tonal problems that are expected.

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to be long term. For example, in anoxia or asphyxia cases, high tone may last for one to three days, after which recovery with resulting normal tone and subsequent normal development may occur. When a long-term problem of high tone persists for five or more days and interferes with joint mobility to any significant degree, the use of the seat may be indicated.

Materials for Basic Seat

The following materials are needed to construct the seat:

1. Polyfoam of medium or firm density, 45.5 cm × 28 cm × 10 cm (18 in. × 11 in. × 4 in.). (Polyfoam can be purchased at an upholstery or foam store or a well-stocked sewing center.)

2. A round trash can or plastic bucket with a diameter of 23 cm (9 in.) and a height of 26.5 cm (10.5 in.). For a small infant weighing from 1 to 3 kg (2 to 6.5 lb), a large, empty, cleaned bleach bottle will also work.

3. Lamb’s wool or soft padding for the seat cover, 61 cm × 91.5 cm (2 × 3 ft). (If two covers are made, one can be washed while the other is in use.)

4. Two cloth straps, to be used as seat and chest belts, 61 cm (2 ft), with hook-and-pile Velcro sewn onto them.

Materials for Optional Headpieces

The following materials are needed to construct the optional headpieces (see Figures 2 and 3):

1. Polyfoam of medium or firm density, 18 cm × 15.5 cm × 6 cm (7 in. × 6 in. × 3 in.), for headpiece that is used with the basic seat.

2. Orthoplast or other thermoplastic material 23 cm × 10 cm (9 in. × 4 in.) for the headpiece that fits in an oxygen hood.

Tools for Construction

The following tools are needed to construct the seat: heavy-duty scissors, a ruler, and a standard sewing machine. For the optional head positioning device(s), small- or medium-sized rivets, a rivet hole...
punch, a hammer, and a heat gun are needed.

**Procedure**

1. Cut out the Polyfoam block, which serves as the support base (see Figure 4), and cover with a pillowcase from the nursery to keep it clean.

2. Cut a "window" in the plastic bucket (see Figure 5), saving the cutout for later use as an extension to the back of the seat to accommodate the infant's growth.

3. Cut, sew, and fold the lamb's wool (see Figure 6).

4. Cover the plastic bucket with lamb's wool padding and insert the bucket into the support base.

   The optional headpiece for use with the oxygen hood should be riveted to the plastic bucket before the lamb's wool has been applied (see Figure 5). When the back of the seat is extended, the bucket cutout is riveted to the back of the chair and covered with an additional piece of lamb's wool.

   The cost of materials is between $8 and $15, depending on the type and number of adaptations chosen. Construction time is 30 to 45 minutes.

**Case Example**

A 40-week (term) microcephalic infant born in a normal, spontaneous vaginal delivery had high extensor tone throughout upper and lower extremities, the trunk, and the neck. Her posture was that of severe shoulder retraction, the arms tightly adducted and extended, with a resultant inability to bring the hands to midline. She was agitated and very difficult to calm.

To control her temperature, she was placed in an isolette, which limited handling by the ICN staff and reduced auditory and visual stimulation. The high tone and hip adductor spasticity also interfered with basic nursing care, especially with diapering, bathing, and feeding. All of these problems had the potential to interfere with the acquisition of normal developmental skills.

After the infant was placed in the positioning seat, her agitation decreased, and within ten minutes she showed improved posture with less marked extensor patterns of the trunk and upper and lower extremities. The infant's positioning schedule during the first week alternated between four hours in the seat and two hours out of the seat. Agitation decreased each time she was put into the seat. Within five days of following this schedule, the reduced tone was noted to carry over into the first hour outside the seat. After seven days, extensor tone was reduced for up to two hours each time she was outside the seat. The amount of time spent in the seat was then gradually diminished depending on the duration of the reduction of the residual extensor tone.

Both upper extremities were now at midline 70% of the time, frequently touching each other and often brought to the mouth. (Bringing the hand to the mouth is often a satisfying and calming experience for the infant, which further helps diminish the abnormal tone.) The lamb's wool padding of the seat helped the infant retain heat so that she could be removed for one- to two-hour periods from the temperature-regulated isolette. The reduction in tone also made nursing care (e.g., diapering, bathing, and feeding) much easier.

**Discussion**

This seating device allows for multiple position changes, yet fits easily inside an ICN isolette. The bucket part of the seat can be rolled inside its base of support to allow the infant to lie on either side or supine. (The sidelying positions are preferred for improved tonal control.) The bucket can also be removed from its foam block and fastened into an infant seat, a car seat, or a high chair.
The seat can be adapted for those infants who need oxygen hoods with the help of the optional headpiece shown in Figure 3.

The seat can be adapted for infants of various sizes. For the smaller 1-kg (2.2 lb) infant, extra padding of lamb's wool can be added to the inside perimeter of the bucket. As the infant grows, it can be removed. For the larger infant, extra height is achieved by riveting the plastic cutout to the posterior portion of the bucket.

The seat provides a greater variety of positions and better support than the NICU isolettes, which, in our experience, were hard to adapt: sandbags, blankets, and other positioning aids had to be frequently repositioned because of the infant's agitated movements.

The seat helps the infant acquire developmental skills. Since the seat positions the infant's hips and knees at a 90° angle, it breaks up the extensor tone, permitting the infant to bring the upper extremities to midline. Also, the curvature of the seat protracts the shoulders more naturally, further breaking the extensor pattern. As both upper and lower extremities acquire more normal and varied movement patterns (6), increased skills, such as kicking, reaching, and clapping, can occur (5). The two headpieces allow the infant enough motion to increase head control skills. Increased head control can enhance eye-tracking skills, which, in turn, help the infant develop eye-hand coordination skills.

The thermal properties of the lamb's wool help keep the infant warm, enabling him or her to spend more time outside the isolette and interact more with the family and the NICU staff.

Agitated behavior and irritability decrease when the infant is in the seat, probably because the discomfort of the extensor pattern, which leaves the infant out of control, is decreased. This is similar to the practice of tightly swaddling (normal) fussu infants in order to calm them by controlling their movements; the seat, by breaking up the extensor pattern, gives some control of motion back to the infants. However, unlike the swaddling, it also permits movement.

The decreased agitation and irritability of the infant leads to increased nursing interaction: The nurses' interest in the infant increases and they spend more time with the infant. Furthermore, the nursing staff can perform basic tasks, such as bathing and diapering, more easily and with less interference from lower extremity scissoring. The enhanced quality and quantity of nursing interaction is of
great importance considering the amount of nursing time and effort these infants require.

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REFERENCES