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Practice Forum

Sup-ER orthosis: An innovative treatment for infants with birth related brachial plexus injury

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Impairments in active and passive range of upper extremity supination and shoulder external rotation are common sequelae for children with delayed recovery from birth related brachial plexus injury. Orthotic intervention may complement traditional treatment strategies commonly employed in the newborn period. These authors describe their custom fabricated orthosis designed to balance shoulder growth and muscular function, and improve prognosis of long term functional outcomes for children with birth related brachial plexus injury. — VICTORIA PRIGANC, PhD, OTR, CHT, CLT, Practice Forum Editor

Birth related brachial plexus injury (BRBPI) occurs in 0.9–4.6/1000 births globally,^{1–6} with spontaneous recovery of functional levels reported to occur in 50–92% of patients.^{1,2,6–9} Almost universal outcomes of BRBPI, even for children with otherwise “good” recovery, are impairments in both active and passive range of upper extremity supination (Sup) and shoulder external rotation (ER).^{4,6,10} Poorly positioned (Fig. 1) and contracted shoulder musculature, and associated skeletal changes can secondarily prevent full range of even otherwise recovered muscle action, and potentially result in significant functional consequences.⁹ While awaiting maximal nerve recovery, traditional treatment goals have included prevention of joint contractures, strengthening of recovering muscles, sensory stimulation, and encouraging developmental milestones.⁹

Ter Steeg, Hoeksma, Dijkstra, Nelissen & De Jong (2003) reported that shoulder bracing for BRBPI was recommended in the first half of the twentieth century, but subsequently advised against with inference made to concerns related to the development of shoulder ER and abduction contractures associated with orthotic

use, and henceforth is seldom mentioned in modern literature.¹⁰ However, orthotic use is described by Chan (2002) as one of the most useful modalities to prevent joint contractures, minimize deformities, and substitute loss of motor control following a peripheral nerve injury.¹¹ Ter Steeg et al (2003) concluded that the use of arm braces “during the period of flaccid palsy of the shoulder muscles be reconsidered, but could only be justified after a randomized clinical trial” (p. 7).¹⁰

Purpose of this orthosis

Our clinic team speculated that if the arm could be practically, safely, and comfortably supported for the majority of the day in a position of the most glenohumeral congruity achievable and with the tightest muscles held lengthened (i.e. into forearm supination and shoulder external rotation) then the normal anatomic growth of the shoulder may be better maintained until nerve recovery allowed for active movement to return.¹² Indications for use of the Sup-ER orthosis (Fig. 2) include infants presenting with major weakness or tightness of shoulder ER, beyond the recovery period anticipated for a neuropractic injury. At our center, based on clinical assessment of the child at about 4–8 weeks of age, defining criteria include tightness in passive range of motion of shoulder external rotation (any angle of less than 180° from the

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Fig. 1. Typical arm resting posture in BRBPI.

abdomen in ER), and/or, using the Toronto Active Movement Scale,¹³ a score of ER \leq 2, and/or Sup \leq 2.¹²

Materials used

- 1.6 mm aquaplast (or preferred light weight thermoplastic), preferably not perforated
- Neoprene plush
- Velcro
 - Hook and loop
 - Adhesive and non-adhesive



Fig. 2. Right arm Sup-ER orthosis (With kind permission from Springer Science and Business Media).¹²

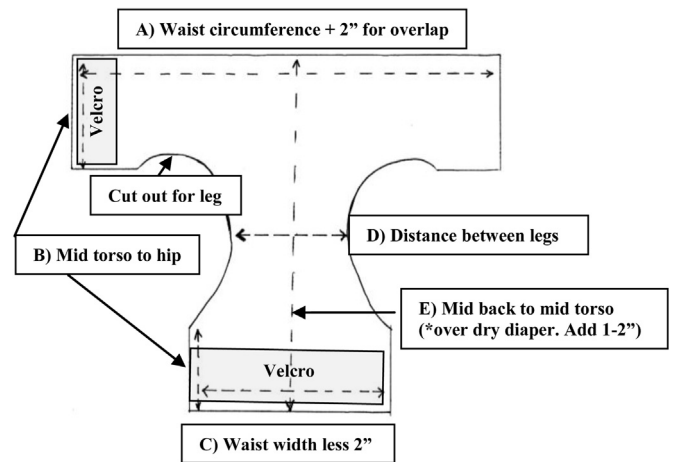


Fig. 3. Waistband pattern.

- 2 D-rings and rivets, or thermoplastic hooks
- Hapla fleece
- Super wrap by Fabrifoam

Fabrication

Waistband

- See Fig. 3 for pattern and required measurements.
- Trace pattern and cut out neoplush.
- Sew Velcro closures to waist band and nappy strap (Fig. 8).

Long arm orthosis

1. To create a pattern, measure the baby's arm length from the distal metacarpal phalanges to top of the humerus, and arm circumference at largest part. This will give you a rectangular pattern.
 - Cut out thermoplastic.
2. Punch a hole for the thumb, positioned about 1 inch from long edge and $\frac{3}{4}$ inch from width edge of thermoplastic.
3. With the arm positioned in 15–20° wrist extension, and maximum tolerated supination and elbow extension, slide thumb through the hole and mold the thermoplastic on the anterior surface of the arm/hand, wrapping circumferentially to secure the thermoplastic in place while positioning. Stay as high up the arm as possible.
4. Once thermoplastic has cooled, remove from the infant's arm and trim edges as needed.
 - Do not trim the thumb hole too large as the orthosis may rotate on the hand if the infant is resisting the supinated position.
 - Clear the distal palmar crease.
 - Cut proximal end on an angle to optimize orthotic length laterally without impinging on the axilla.
5. Line edges with hapla fleece (for comfort).
6. Anchor Velcro strap across dorsal hand (Fig. 4), to assist caregivers in securing the orthosis on the arm.
7. Attach Velcro straps (using rivet and D-ring for added adjustability, or thermoplastic hook) at (1) lateral elbow, and (2) proximal/anterior aspect (Fig. 6).
 - These straps should be long enough to extend from the orthosis to the posterior aspect of the trunk, to secure the arm in SUP and shoulder ER when the baby is lying supine.

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