Background

- Perinatal brachial plexus injury (PBPI): results from traction to the brachial plexus (CS-T1) in utero or during the birth process.
- PBPI places infants at risk for arm weakness & sensory deficits which can lead to arm disregard or prehensile difficulty.
- Slow axon regrowth, deviant reinnervation & disuse atrophy, contribute to muscle imbalances, muscle shortening, joint contracture, & posterior glenohumeral joint subluxation.
- Given the risk for disuse & musculoskeletal deformity, the need to foster active movement early through targeted intervention is critical.

Hypotheses

- Infant/toddlers can learn the contingency between biceps activation & musical-video feedback. Biceps was chosen as target muscle since recovery of biceps function is reportedly predictive of outcome after PBPI.
- We also hypothesized that wrist accelerometry & the Almli Test of Handedness would be equivalent measures of arm activity.

Methods

**Subjects:** Nineteen infant/toddlers < 2 years participated; PBPI (n=6) and typically developing (TD, n=13)

**Inclusion Criteria:** BSID III ≥ 25th percentile and score ≥ 1 for elbow flexion (isometric) based on the Active Movement Scale.

**Dependent Measures:** 1) Integral of Biceps activation (Vs); 2) Arm activity: Accelerometry at Almli Test of Handedness

**Equipment:** 1) Bipolar SEMG electrodes mid-biceps (1000 Hz; Delsys); 2) Opal Accelerometers (APDM, Portland, OR)

### Session 1 - Baseline

- BSID III
- AMS, Almli
- No Feedback (100x/s/arm)
- Aug SEMG (15s/trigger)

### Session 2 - Intervention

- T1: Feedback (300x/s/trigger)
- Biceps Activation > Threshold
- Triggers Video to Play

### Results

**Muscle Activation Increased with Training**

- Mean suprathreshold biceps activation (Vs) significantly increased from baseline to the 3rd interval of training in the right arm of the TD group & the 2nd & 3rd intervals of training in both arms of the PBPI group.
- Mean integral in PBPI group was higher than the TD group

**Individual Data**

- Suprathreshold biceps activation (Vs) increased from baseline to at least 1 of 3 intervals of training in one arm of 12/13 TD children and 6/6 children with PBPI.
- Individual data for both arms of PBPI group was less variable than the TD group

**Hand Preference & Resultant Acceleration**

- A laterality index (LI) was used to determine hand preference from findings on the Almli Test (LI = -1 = Left; > 1 = Right; -1 = 1 = Mixed)
- Mean ratio of the resultant wrist acceleration (m/s^2) during the Almli Test in the affected/unaffected arms of the PBPI group was moderately correlated with LI (r = -0.43) whereas the ratio for the left/right arms of the TD group correlated poorly with LI (r = 0.16)

**Conclusions**

- All participants generated suprathreshold biceps contraction to trigger the music/video reinforcement to play
- Average visual attention on video > 80% of on-time in both groups
- Accelerometry could be used to estimate change in the ratio of arm activity from baseline following intervention

**Future Direction**

- Future work: experimental vs sham intervention, longer training period, user friendly home unit, other populations at risk
- Examine efficacy of alternate reinforcement (i.e., switch toys)

**References**


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