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A Pilot Study of the Effect of an Acute Vestibular Therapy on Postural Stability, Gait Variability, and Gaze Patterns of Children with ASD

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Study Background

1. Autism Spectrum Disorder (ASD)
   a. Developmental disorder that affects socialization, language, sensory integration [1].
      i. Impairment of sensory systems can affect a child’s ability to concentrate, socialize, be comforted, appropriately respond to environmental changes, learn academic material, and ‘follow the rules’
   b. Children with ASD have been found to have:
      i. A greater degree of postural variability and sway [2, 3].
      ii. Increased variability in stride length and duration, increased variability of gait, increased stance times, and increased hip flexion at “toe-off” [4, 5].
      iii. Abnormal gaze patterns represented by less eye contact and increased gazing at the mouth of speakers and peripheral objects [6, 7].
   1. Abnormal gaze patterns are theorized to be self-regulatory mechanisms to aid a child struggling with integration of visual input [8, 9].

2. Sensory Integration Therapy
   a. Multiple novel sensory experiences combined with physical and cognitive challenges help the brain learn to better organize sensory input
   b. Currently there are no biomechanical analyses of SI
   c. Benefits of increased understanding of SI
      i. Identify Best Evidence Based Practices
      ii. Improve therapy equipment and insurance practices

Research Question and Hypothesis

Research Question: What are the physiological responses of children with ASD to a sensory integration therapy? Specifically, what is the effect of an acute vestibular therapy on postural stability, gait variability, and gaze patterns of children with ASD?

Hypothesis: Subjects with ASD will display a significant increase (p<0.05) in postural stability, a decrease in gait variability, and a decrease in self-regulating gaze patterns after undergoing a vestibular therapy session.

Methodology

Subject Population
12 males with ASD ages 6-10, verbal, medication free.

Baseline Testing
Purpose: to obtain an approximation of subject’s physical abilities, help explain results, relate subjects to each other

- Functional Reach Test
- BOT2 Bilateral Coordination Test
- Pre-Swing Testing
  - Balance Testing
  - Four conditions: eyes open, eyes closed, eyes open on foam, eyes closed on foam.
- Gait Testing
  - Walk a 30’ path wearing an OPAL IMU
- Eye gaze testing
  - Participate in social play while wearing mobile gaze tracker

Vestibular Swing Routine
Five minute swing protocol that includes a wide range of movements, activities, and challenges

Post-Swing Testing
Postural stability, gait, or gaze will be retested after conducting the vestibular swing routine

Analysis

Postural Stability Data
Evaluation of center of pressure (COP) movements: mean sway velocities, root mean square, sway area [3]

Looking for: a significant decrease (p<0.05) in center of pressure velocity and sway area to indicate improved postural stability

Gait Data
Variability analysis of gait velocity, cadence, step length, and a comparison to standard gait patterns [4]

Looking for: a significant decreased in standard deviation of step length, gait velocity, and cadence indicates decreased gait variability

Gaze Data
Yarbus software used to identify fixation points [10]

Looking for: significantly increased fixation on socially relevant objects (e.g. faces), indicates a decrease in self-regulating gaze patterns

Future Plans
Pass IRB approval, recruit subjects, and conduct pilot study Summer 2012.

Next Step

Sources

[2] Yarbus software used to identify fixation points [10].