Efficacy of a Perceptual-Motor Intervention for Sitting Postural Control in Children with Moderate to Severe Cerebral Palsy Using Measures of Complexity

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INTRODUCTION

- For infants with moderate to severe cerebral palsy, independent sitting is a means to functional independence
- Sitting is a major focus of therapy for children with cerebral palsy. However, small increments of progress are difficult to quantify to determine effectiveness of intervention
- The center of pressure (COP) is a reflection of overall postural control
- The nonlinear measure, Lyapunov exponent (LyE), quantifies the stability of a swaying body as posture is controlled, and is a measure of complexity.
- LyE was the only measure revealing significant differences between infants with typical development and infants with delayed sitting development.
- The nonlinear measure, Approximate entropy (ApEn), quantifies the regularity of posture control over time, and also describes complexity.
- Discriminant Analysis revealed LyE (medial-lateral) and ApEn (medial-lateral) classified 100% of infants correctly as CP or typical when used with linear variables; therefore, we chose these 2 variables as measures of intervention effectiveness.

METHODS

- Subjects: 30 infants with typical development, starting at age 5.0 (SD = 0.6) months, and 14 infants with moderate (GMFCS III) to severe (GMFCS IV) cerebral palsy, ages 12-24 months.
- Infants were placed in a sitting position on a force plate, and then allowed to sit independently while stabilograms were collected.
- Six trials were recorded as the infant was just able to sit (month 1), and then repeated each month for 4 months.
- Infants with CP were randomly assigned to twice weekly perceptual-motor intervention for 8 weeks (N=7), or once weekly home consultation for 8 weeks (N=7). Follow-up data was collected at 12 weeks.
- GMFM sitting dimension was tested before and after the 8 weeks of intervention.

RESULTS

- Repeated measures mixed ANOVA with post-hoc analysis revealed significant differences (P<0.008) in the LyE medial-lateral variable between the typical infants and infants with CP at all sessions except the last, when the significant difference was only between the typical infants and the infants with CP in the home program.
- The ApEn medial-lateral variable showed significant differences only between the groups at the last session between the typical infants and the infants with CP in the home program (P=0.05).
- The GMFM sitting section change scores did not reveal significant differences between the treatment groups.

CONCLUSIONS

- LyE and ApEn are sensitive to small increments of change in sitting postural control, and can be useful to examine effectiveness of intervention.
- GMFM sitting dimension change scores did not appear sensitive to small changes in sitting postural control.
- Infants with moderate to severe CP who engaged in a twice weekly perceptual-motor intervention showed stability and regularity characteristics of the COP in sitting that were closer to the typically developing infants at follow-up than the infants in the home program. Complexity of sitting postural control as measured by these variables increased with twice weekly intervention.

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