

TEST-RETEST RELIABILITY OF SITTING POSTURE IN TYPICALLY DEVELOPING INFANTS.

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INTRODUCTION

The study of the center of pressure (COP) in standing has led to specific therapy programs to improve standing postural control. Clinical rehabilitation programs use force plate technology and the COP for both assessment and treatment of balance disorders. Research has revealed the benefits of these programs. However, the use of this technology has been limited to adults and older children who can achieve the standing position (Cherng *et al.* 1999). Researchers have not yet shown its usefulness for the infant population or for postural control in the sitting position. Furthermore, COP data have recently been analyzed with nonlinear measures which have provided additional insights into behavioral strategies during posture (Newell *et al.* 1993) However, the reliability of this methodology for evaluating COP time series during sitting posture in infants has not been investigated. Therefore, the purpose of our study was to determine the reliability of linear and nonlinear tools, including intra-session and inter-session reliability, for the sitting posture in typically developing infants.

METHODS

Ten typically developing (TD) infants participated in the study. All TD infants scored above -0.5 SD on the Peabody Developmental Scales. Infants were recruited when they were just developing the

ability to sit upright. Each came to the lab twice per month for four months. The first three acceptable trials at each session were used to determine intra-session reliability. The TD infants returned for a repeat testing within one week of each month's testing for the inter-session reliability portion of the study. Each trial consisted of recording COP data at 240 Hz for 8.3 sec of unsupported sitting on an AMTI force plate (Advanced Mechanical Technology Inc. Newton, Massachusetts, Model OR6-7-1000). The COP data were analyzed using two common linear and two nonlinear parameters. Linear tools consisted of Root Mean Square (RMS) and Range for both the anteriorposterior and the mediolateral direction. Nonlinear parameters consisted of the Approximate Entropy (ApEn) and the Lyapunov Exponent (LyE) for both directions. Intra-session and inter-session reliability was quantified by the Intraclass Correlation Coefficient (ICC). Specifically, a one way ANOVA model with a random subject effect was used to estimate the intra-session reliability based on data from the first visit for each child. A two way ANOVA model with a random subject effect and a random session effect was used to estimate the inter-session reliability based on the average measurement during each session. Based on Rosner (2000), an ICC of less than 0.4 indicates poor reproducibility while an ICC between 0.4 and 0.75 indicates fair to good reproducibility. Lastly, an ICC over 0.75 indicates excellent reproducibility.

RESULTS

Inter-session ICC's for all parameters were between 0.37 to 0.56. ApEn presented similar ICC's with range and RMS in both directions, which is a fair to good reproducibility. However, LyE presented poor reproducibility (Table 1).

<i>Nonlinear Variables</i>	<i>ICC's</i>	<i>Linear Variables</i>	<i>ICC's</i>
ApEn x	0.50	Range x	0.52
ApEn y	0.56	Range y	0.40
LyE x	0.37	RMS x	0.51
LyE y	0.40	RMS y	0.37

Table 1. Inter-session correlation coefficients.

Intra-session ICC's for all parameters were between 0.26 to 0.66 (Table 2). ApEn presented the higher ICC's falling in the fair to good category. Both linear parameters presented fair to good reproducibility, however lower than ApEn. Lastly, LyE presented poor reproducibility.

<i>Nonlinear Variables</i>	<i>ICC's</i>	<i>Linear Variables</i>	<i>ICC's</i>
ApEn x	0.58	Range x	0.50
ApEn y	0.66	Range y	0.43
LyE x	0.26	RMS x	0.47
LyE y	0.37	RMS y	0.49

Table 2. Intra-session correlation coefficients.

CONCLUSIONS

Linear parameters showed fair to good reproducibility in both inter- and intra-session analysis. ApEn presented the highest ICC values in both inter- and intra-session analysis, while LyE showed poor reproducibility. Reproducibility of linear parameters during infant sitting task showed similar results to standing in adults (Brouwer *et al.* 1998). In addition, the ICCs

of linear parameters during infant sitting were similar to those of children without disabilities during standing balance tasks (Liao *et al.* 2001). However, regarding nonlinear parameters, no comparison can be made, since the reliability of nonlinear analysis of COP time series has not yet been explored. We need to state here, that these are preliminary data of an ongoing project. The limited number of subjects may have influenced the results. However, even with this limitation taken into account, ApEn, which is a measure that can quantify the regularity of posture over time, was able to show higher reproducibility within and between session of infant sitting posture in comparison to other linear and nonlinear parameters.

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