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Changes in Sitting Control Affect Toy Exploration During Infancy

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Introduction

- ❖ The ability to sit changes how much infants are able to explore toys (Harbourne, Ryalls, & Stergiou, 2014). Infants who can sit upright can explore their environment more effectively than prop sitters, as their hands are free to explore (Soska & Adolph, 2013). Thus, advances in infants' sitting likely enable infants to explore objects more effectively.
- ❖ We seek to understand how sitting control and type of sitting change the amount of object exploration across the initial emergence of sitting.
- ❖ Hypothesis: Infants with greater sitting control at their first assessment will explore more frequently, than infants with poorer sitting control at their first assessment.
  1. Prop sitters will explore objects less frequently, than arms-free sitters.
  2. Infants with greater trunk angle difference (i.e., who fall further after losing support) will explore objects less frequently, than infants with lower trunk angle differences (i.e., who do not fall as much after losing support)..

Method

Participants:

- ❖ 30 typically-developing infants (18 females) were recruited at the onset of sitting emergence
  - Enrollment mean age=5.68, range: 4.3-6.9 months
  - Race characteristics: 83.4% Caucasian, 10% African-American, 3.3% multiracial, 6.7% other
- ❖ Eligibility: younger than 7 months, and no history of delay, preterm birth or significant health conditions
- ❖ "Sitting emergence" – infants had to be capable of sitting propped on their arms for 3+ seconds through arms-free sitting for <1 minute without the ability to change positions (e.g., get into four-point).

Methods

- ❖ Infants were assessed across 3 longitudinal visits: baseline, 3 weeks later, and 6-8 weeks later
- ❖ At each visit, the Early Problem-Solving Indicator and the Sitting Trunk Angle Task were conducted.

Assessment of Object Exploration

Early Problem-Solving Indicator (EPSI) (Greenwood et al., 2006)

- ❖ The EPSI is a standardized assessment of the infant's play behaviors. Frequency of four behaviors are scored (looks, explores, functions, solutions); however, only explores were marked for this analysis.
- ❖ Frequency of exploration behaviors with 3 standard toys – 6 nesting cups, pop-up toy, gumball machine and 5 gumballs (Fig 1)
  - Each toy set was presented to the infant for 2 minutes, one-at-a-time. Infants sat on the floor, supported by one researcher and a second researcher video-recorded trials.
  - Using Datavyu 1.3.7, reliable behavior coders marked each time the infant explored task toys.
  - Variable – the sum frequency of explorations across all 3 toys divided by sum trial time (Rate of Exploration = Sum Frequency of Explorations/Trial Length in Minutes)

Assessments of Sitting Control

Sitting Trunk Angle Task at Baseline (Surkar, Harbourne, Willett, & DeLong,, 2016)

- ❖ Sitting trunk angle at baseline was calculated between the leg (foot to hip) and trunk (hip to shoulder)
- ❖ Software – the Angles Applications is a software application used to calculate trunk sitting angle.
- ❖ Procedure – the first researcher supported the infant in sitting on the floor, while a second researcher video-recorded a side shot of the infant, 90 degrees from the infant's legs (Fig 2). The first researcher placed a toy in front of the infant's midline, straighten up the infant's trunk, and release.
- ❖ Using the Angles App, a coder marked the researcher-supported trunk angle (straightened trunk) and the infant-supported trunk angle (released to infant control)
- ❖ Variable: difference in angle from researcher-supported to infant supported angle (Trunk Angle Degrees Difference = Researcher Supported Angle – Infant Supported Angle)

Sitting Stage at Baseline (Harbourne, Giuliani, & Mac Neela, 1993)

- ❖ Infants were grouped into sitting ability defined as one of two stages at baseline.
  - Stage 1 Prop sitters – sits for 3+ seconds, propping up with hands on the floor or on their legs (n=16)
  - Stage 2 Arms-free sitters – sits for 3+ seconds without arm support with frequent losses of balance observed (n=14)

Analytic Plan

- ❖ Both hypotheses will be tested using a multilevel longitudinal model using the software program, HLM 7
  1. Sitting Stage and Exploration Model: Visit (Level 1 IV), Sitting Stage at Baseline (Level 2 IV), Exploration (DV)
  2. Trunk Angle and Exploration Model: Visit (Level 1 IV), Trunk Angle at Baseline (Level 2 IV), Exploration (DV)

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- For any questions about this research, please contact Emily Marcinowski (ecmarcinowski@gmail.com)

Results

Figure 1. Three standard toys included in the EPSI.

Figure 2. A sample camera view of Sitting Trunk Angle task in the Angles Application.

A. Researcher-supported B. Infant-supported angle

Descriptive Analyses

- ❖ The rate of exploration changed linearly (β_{10}=8.57, $t(28)$=3.017, p<0.01) and quadratically across time (β_{20}=-3.88, $t(27)$=-2.91, p<0.01).
- ❖ No differences in trunk angle in sitting were found at the intercept (β_{01}=6.88, $t(29)$=2.25, p=0.03) or over time (β_{11}=-10.97, $t(56)$=-1.64, p=0.11) for prop and arms-free sitters.

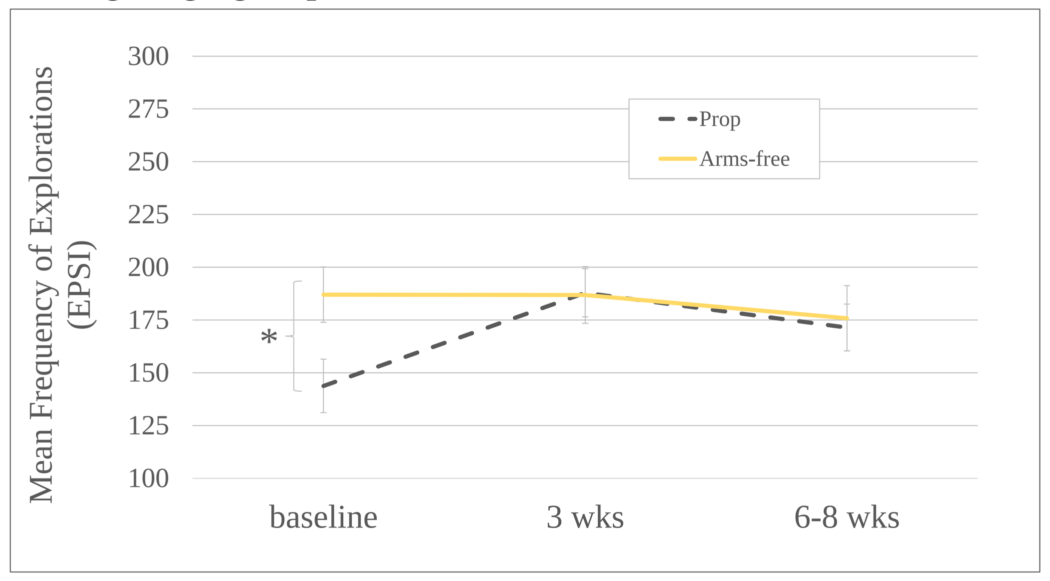
Sitting Ability and Exploration across Time (Hypothesis 1)

- ❖ Arms-free sitters explored more frequently than prop sitters at baseline (β_{01}=6.88, $t(29)$=2.25, p=0.03) (Fig 3)
- ❖ Sitting stage did not predict changes in quadratic change (β_{21}=2.70, $t(26)$=1.03, p=0.31) and approached significance criteria for linear change (β_{11}=--3.68, $t(27)$=-2.03, p=0.05).

Trunk Angles at Baseline and Exploration across Time (Hypothesis 2)

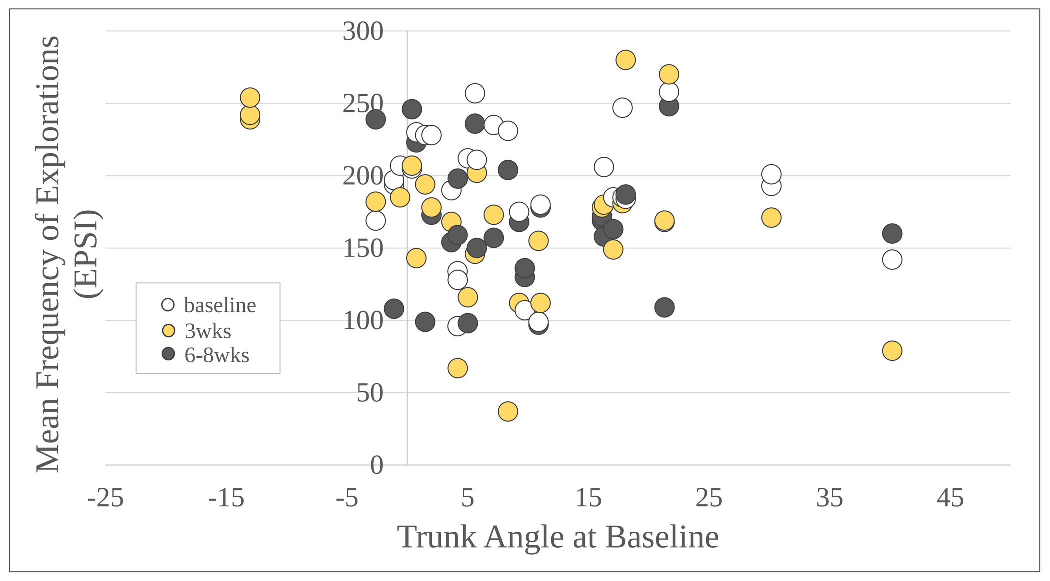
- ❖ No effect of trunk angles at baseline on the rate of exploration across time was found (β_{20}=-0.02, $t(57)$=-0.22, p=0.83) (Fig 4).

Figure 3. Mean frequency of exploration across time by sitting stage group.



* p<0.05

Figure 4. Mean frequency of exploration by Trunk Angles at Baseline.



Discussion

- ❖ More advanced sitters at baseline explored objects for longer, than propped sitters; however, sitting control (i.e., trunk angle) did not predict object exploration.
- ❖ Infants engage in lower durations of focused attention towards objects, once infants are capable of crawling (Surkar et al., 2015) Future research could investigate if and how infants explore objects differently, once they transition from stationary sitting to locomotion.
- ❖ More and more, research has shown that gross motor development gives rise to cognition and language throughout infancy (e.g., Campos et al, 2000). Differing levels of motor skill lead to different learning opportunities in an infant and may facilitate cognitive and language development. Since independent sitting enables the infant to explore objects in their environment, sitting may uniquely predict the development of cognition and language.

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