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Long-Term Object Permanence and Sitting in Infants with Motor Delays

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1 Background/Purpose

- Object permanence is the ability to understand that objects continue to exist even when they cannot be observed.[1]
- Object permanence, a cognitive construct, is grounded in infants' everyday perceptual-motor experience, such as sitting and object interaction.[2-3]
- The development of sitting may also contribute to building cognition through object understanding.
- Adequate postural control in sitting allows infants to process visual information and use their hands freely to manipulate objects, which facilitates cognitive development.[4]
- It is not clear how sitting development relates to object permanence in infants with motor delays.
- The purposes of this study were to investigate the development of OP skill in infants with varying levels of motor delays and the relationship between their sitting skill development and OP skill over time.
- 37 infants with different levels of motor delay were assessed for gains in object permanence and functional sitting between baseline and 12 months.

2 Methods

Participants

- Thirty-seven infants (baseline age range = 7mos, 12dys – 17mos, 16dys) with varying degrees of motor delays (mild, moderate, and significant) were recruited as part of a larger study (START-Play).
- Inclusion criteria:
  - > 1SD below mean for corrected age on motor domain of the Bayley Scales of Infant and Toddler Development
  - 7-16 months of corrected age
  - Ability to sit propping with their arms for at least 3 seconds but unable to get in and out of sitting (sitting emergence)
- Exclusion criteria: blindness, progressive disorder

Procedure

- The Object Permanence Scale (OPS), and Gross Motor Function Measure-88[5] Sitting Dimension (GMFM-SD) measured at baseline, 1.5mo, 3mo, 6mo, and 12mo.

Object Permanence Scale (OPS)

- Consists of 7 tasks extracted from developmental studies on object permanence.[6]
- Developed to measure OP from minimal to advanced skills, scaled from 0-20.
- During the test, infants sit on the floor or in a supportive chair depending on their ability to maintain a sitting position.
- OP videos were coded using Datavyu coding software, which enabled a frame-by-frame analysis of partial scores (e.g., joint attention and reaching).

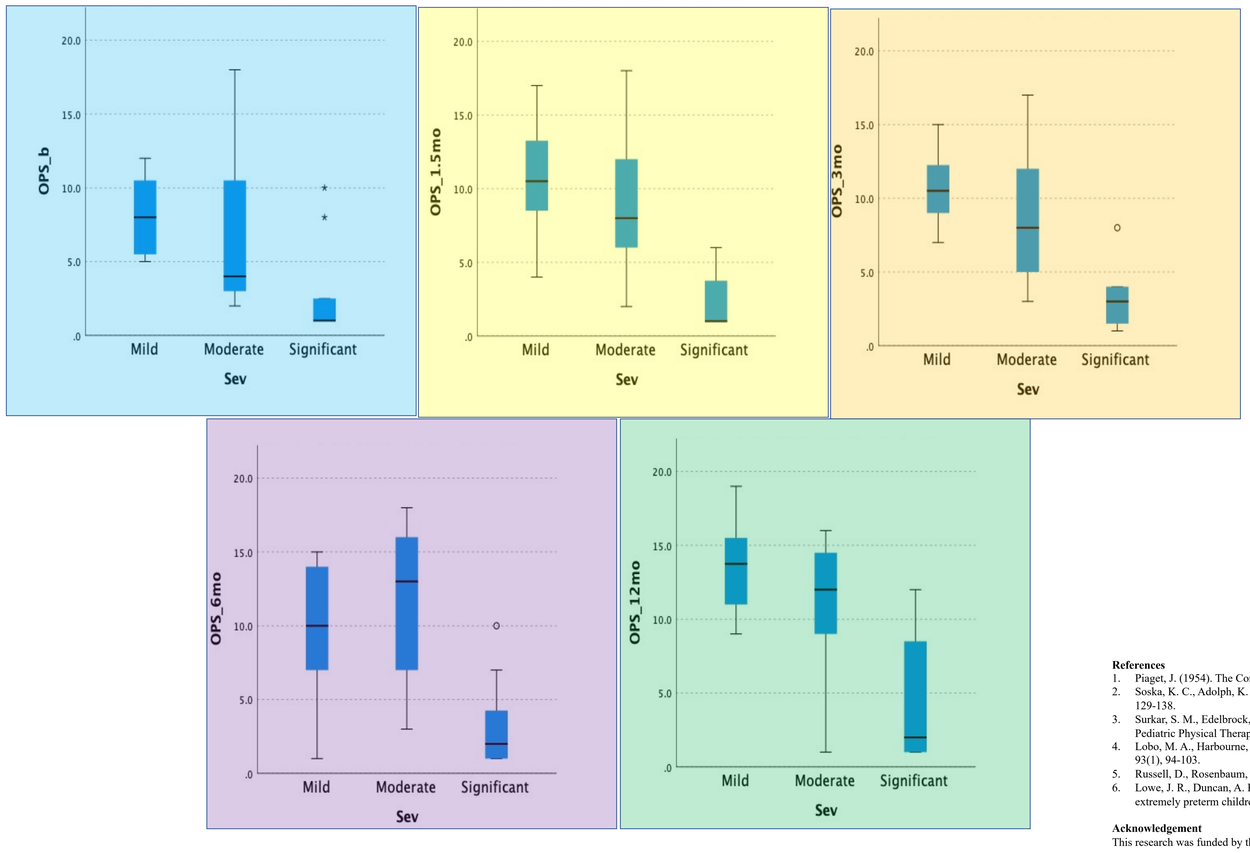
Analysis

- Kruskal-Wallis test with Bonferroni correction and Dunn's post hoc test
  - Predictors = GMFM-SD change
  - Outcome = OPS scores
- Spearman Rho correlation of OPS and GMFM-SD change scores between baseline and 6mo and baseline and 12mo
- Multiple raters scored OPS videos, with 20% of all videos re-scored for inter-rater reliability, which ranged from 81.90% to 95.14% agreement.

Task	Behavior
1	Child looks at object Child looks at object in one location, then shifts gaze to new location to find object when object is moved Child re-orients body posture to follow object moved out of view (e.g., looking over edge of tray in highchair when toy dropped)
2	Looks inside of wide container and attempts to retrieve toy dropped inside
3	Pulls cloth off toy after watching toy being slid under cloth OR Pulls cloth off interesting toy after watching cloth being placed and toy partially visible
4	Pulls cloth off interesting toy after watching cloth being placed and toy completely covered, with identical cloth nearby
5	Finds a toy hidden under one of two cups
6	Find a toy hidden under one of two cups when the cups are reversed after the toy is hidden
7	Double visual displacement used as a toy is hidden under one cup, removed and hidden a second time under the second cup

3 Results

- Significant differences were found between the mild, moderate, and significant groups' OP scores at all 5 assessments ($p \leq .001$).
- Dunn's post hoc test showed significant differences between the mild and significant (adj. p range = <.001 - .008) and the moderate and significant (adj. p range = <.001 - .018) groups for OP scores at each visit.
- No significant difference was found between the mild and moderate (adj. p range = .407 – 1) groups.
- Spearman's rho statistic showed significant positive correlations between OP and GMFM-SD scores with r ranging from .503 to .762 ($p \leq .001$) for all 5 assessments.
- Correlations of change scores between baseline and 6-months, and between baseline and 12-months, revealed weak positive correlations for both 6- (r = .323, p = .051) and 12-months (r = .327, p = .048) assessments.



4 Clinical Relevance

- Therapists should understand that infants may be building cognitive constructs during the emergence of sitting function.
- Cognitive tasks should be a focus while building functional motor abilities.
- Children with significant motor delays should receive intervention services as early as possible.

5 Conclusions

- Advancement of object permanence may be related to sitting development, in addition to advances previously noted in self-mobility studies.
- Infants with mild or moderate motor delays scored significantly higher in OP skill than infants with significant motor delays. Even though object permanence and sitting ability were significantly correlated at each assessment, the weakly correlated change scores from baseline to 6- and 12-months suggests a non-linear progression of these skills.
- Long-term follow-up could reveal a critical linkage between motor delays, OP development, and resulting cognitive development.
- As infants discover new motor skills, other skills, including cognitive skills, may not receive the resources needed for the expected performance. Therefore, measured cognitive skills may appear to decrease, which could be due to a cognition-action tradeoff.

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