Modification of the Postrotary Nystagmus Test for Evaluating Young Children

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Introduction

• Why do we need to measure sensory integration functions in young children?

• What measures are currently available?
What is Postrotary Nystagmus (PRN)?

A normal vestibulo-ocular reflex
Why does vestibular function matter?

State of arousal

For calming or alerting
Why does vestibular function matter?

- **Postural Control**
  - Vertical head and trunk position
  - Postural tone, particularly extension
  - Balance and equilibrium
- **Laterality, midline integration**
- **Bilateral coordination**
Why does vestibular function matter?

- **Ocular Control**
  - maintaining a stable visual field

- **Spatial Orientation**
  - Directionality
  - Navigation
Clinical Impetus for Project

• Testing PRN in children who could not perform standardized procedures

• Does holding child in place affect the reflex?
Clinical Impetus for Project

• Observation that age trend is stable in children 4.0-8.11 years

• Would duration be the same for children under age 4?
Purpose of the Project

• Project 1: Is there a difference in PRN when children are tested in the standard administration versus an adult-held position?

• Project 2: Does PRN duration in children under age 4 years differ from PRN norms for children over age 4?
Participants: 37 children 4 – 9 years old

• Each child was tested in two conditions: Using the standard (1’ X 1’) with child sitting independently vs. a child sitting in adults lap on larger (2’ X 2’) rotary board

• Duration of PRN was measured in standard (C1) and adult-held (C2) administrations
Child held by adult on large PRN board
### Project 1: Adapting the PRN test

**Analysis & Results**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Independent</th>
<th>Adult Held</th>
<th>Mean Difference</th>
<th>t-value (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting (C1)</td>
<td>Sitting (C2)</td>
<td>(C1-C2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>(SD)</td>
<td></td>
<td>df=36</td>
</tr>
</tbody>
</table>

| C1 vs. C2 (clockwise)       | 5.27 seconds| 6.30 seconds| - 1.03 seconds  | -1.46 (0.15)      |
| (clockwise)                 | (6.70)      | (6.02)      | (4.28)          |                   |

| C1 vs. C2 (counterclockwise)| 4.79 seconds| 5.83 seconds| -1.06 seconds  | -1.38 (0.18)      |
| (counterclockwise)          | (5.52)      | (6.23)      | (4.58)          |                   |

P-value presented for 2-sided t-test. Significant differences determined at alpha p<0.05
Project 2: The Adapted PRN Test in Young Children

1) Is it feasible?
2) Will parents and children younger than age 4 accept it?
3) Will there be a difference in duration of the PRN reflex for younger children (<4 y.o.) compared to normative data for children aged 5 y.o. (Southern California Postrotary Nystagmus Test manual)?
Comparison to SCPNT was selected since the mean and SD scores were published for this test (versus the SIPT) and the PRN test was the same in the SCPNT and SIPT. Norms in the SCPNT started at 5 years of age.
Project 2: The PRN Test in Young Children

Methods

Participants: 44 typically developing children under age 4 years (2 to 47 months)

- Children’s heads were positioned by the examiner in 30 degrees of forward flexion and maintained by the person holding the child while sitting on the rotary board.
- Two administrations: clockwise and counterclockwise
- The person holding the child lifted their head to a neutral position while the examiner observed the PRN response.
- Children’s and parents’ responses to the testing were noted during and following each of the test administrations.
Is it feasible?

• Either a parent (n=14) or another individual (therapist, sibling, friend, n=30) held the child while seated on a large PRN board.

• Most children (39 out of 44 children) did not object to getting positioned on the board. Of the 5 children who “fussed” while being positioned, only one child continued to cry after rotations started.

• Adults were able to hold the child in place, lift the child’s head upon stopping, and the reflex was observable to the therapist, i.e. children did not close their eyes or move.
Project 2: The PRN Test in Young Children

Results

Will parents accept it?

- The usefulness and meaning of the PRN test and its relevance appeared clear to parents.
- Parents were able to make easy comparisons between the vestibular system and its role in their child’s development:
  
  “Yes, he really likes movement”
  “She is not very comfortable with swings”

All parents expressed that they were comfortable with the procedure that took less than one minute.
### Table 2. *t*-test comparison of PRN duration (in seconds) between children < 4 years old (2-47 months) and 5 year olds

<table>
<thead>
<tr>
<th>Direction of rotation</th>
<th>&lt;4 yrs.</th>
<th>5 yrs.</th>
<th>t-value (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter-clockwise, mean seconds (sd)</td>
<td>9.1 (3.2)</td>
<td>8.9 (3.6)</td>
<td>0.27 (0.78)</td>
</tr>
<tr>
<td>Clockwise, mean seconds (sd)</td>
<td>9.3 (2.5)</td>
<td>8.7 (3.7)</td>
<td>0.89 (0.38)</td>
</tr>
<tr>
<td>Counter-clockwise+ Clockwise, mean seconds (sd)</td>
<td>18.4 (5.0)</td>
<td>17.6 (6.5)</td>
<td>0.65 (0.52)</td>
</tr>
</tbody>
</table>

P-value presented for 2-sided *t*-test. Significant differences determined at alpha <=0.05.
Ian
12 months
Typically Developing

10 seconds
Average Duration
Dani
10 months
dx: Down syndrome

6 seconds
slightly shortened duration
Results Summary

- Adapting the PRN test to accommodate children who cannot sit independently has no effect on PRN duration.
- No significant differences in PRN duration between younger children (2-47 months) and the 5 year old published norms in the SCPNT.
Implications to Practice

• Early identification is critical
• Along with clinical observations, PRN offers a quick method of assessing one aspect of vestibular function in younger population
• Primate study (Schneider, et al., in preparation) showed that PRN was a strong predictor for later outcomes in development—suggesting application for screening
THANK YOU!
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References


