Exploring the Benefits of a Dynamic Harness System Using Partial Body Weight Support on Gross Motor Development for Infants with Down Syndrome

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Introduction: Down Syndrome (DS)

- Most common chromosomal disorder in US, 1:700 births\(^1\)
- Main cause of moderate Intellectual disabilities\(^1\)
- Present delayed motor development\(^2\)
- Mastery motivation delayed & malleable outcome\(^3\)

\(^1\) Centers for Disease Control and Prevention. Data and Statistics on Down Syndrome, 2022; \(^2\) Lobo et al., 2013; \(^3\) Glenn et al., 2001
Partial Body Weight Support (PBWS) treadmill training is effective for early walkers.\textsuperscript{4} Play enriched environment supports exploratory play.\textsuperscript{5,6} Exploratory play is a key facilitator for motor development in children with DS\textsuperscript{7}

**Aims:** To explore the effects of dynamic harness system within a play enriched environment among infants with DS:
1. Gross motor development (GMFM-88)
2. Parent-reported mastery motivation (DMQ-18)

\textsuperscript{4}Angulo-Barroso et al, 2008; \textsuperscript{5}Fiss et al., 2023; \textsuperscript{6}Ball et al., 2019; \textsuperscript{7}Fidler et al., 2019
Dynamic Harness System

Harness Jacket

Weight Offset

PUMA System

Camera

Play enriched environment
Study Sample

• **Inclusion criteria**
  • **Child:** - DS (any form)
    - < 36 months of age
    - Sit independently
    - Not yet walking
  • **Caregiver:** - English proficiency

• **Exclusion criteria**
  • **Child:** - Uncontrolled seizures
    - Medical precautions for wearing the harness

<table>
<thead>
<tr>
<th>Characteristics (n=15)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months)</td>
<td>19.7 (5.8)</td>
</tr>
<tr>
<td>Gender: Female</td>
<td>9</td>
</tr>
<tr>
<td>Height (ft)</td>
<td>2.4 (0.3)</td>
</tr>
<tr>
<td>Weight (lbs.)</td>
<td>21.8 (2.6)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>8</td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
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</tr>
<tr>
<td>White &amp; Asian</td>
<td>4</td>
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<tr>
<td>Other</td>
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<tr>
<td>Ethnicity</td>
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<tr>
<td>Not Hispanic or Latino/a</td>
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</tbody>
</table>
Methods: Study Design

PILOT RANDOMIZED CROSS OVER

Timeline:
- Recruitment
- Week 1 Baseline Assessment
- Weeks 2-4 3 sessions/week
- Week 5 Mid study Assessment
- Weeks 6-8 3 sessions/week
- Week 9 Final Assessment

Participants Randomization

- Group 1: Play sessions harness engaged (Intervention)
- Group 2: Play sessions harness not engaged (Control)

Recruitment

Baseline Assessment

Week 9 Final Assessment

Final Assessment

Play sessions harness engaged (Intervention)

Play sessions harness not engaged (Control)
Mean Weight Offset Used: 4.8lbs. (±0.9)
Results: Gross Motor Development

Mean Total GMFM-88 (SD)

Baseline
42.9% (±2.3)

Mid study
48.6% (±2.7)

Final Assessment
54.5% (±2.5)

a. Mean Change in GMFM-88 Dimensions (%)

b. Change in Mean Total GMFM-88
Results: Mastery Motivation

Mean DMQ-18 General Competence Score

<table>
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<tr>
<th>Participant</th>
<th>DMQ-18 Dimension</th>
<th>Change</th>
<th>MDC</th>
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<tbody>
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<td>1</td>
<td>Cognitive/object</td>
<td>+1</td>
<td>0.9</td>
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<tr>
<td></td>
<td>persistence</td>
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<td></td>
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<tr>
<td>6</td>
<td>Social persistence</td>
<td>+1.4</td>
<td>0.8</td>
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<td>with children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Social persistence</td>
<td>+1.6</td>
<td>0.8</td>
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<td>with children</td>
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<tr>
<td>13</td>
<td>Social persistence</td>
<td>+1.6</td>
<td>0.8</td>
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<tr>
<td></td>
<td>with adults</td>
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</table>

Data were derived from Morgan et al. (2020)
Discussion

**Gross Motor Development**
- Align harness benefits for infants with DS
- Support the parent reported positive changes in atypically developing infants’ using PBWS

**Mastery Motivation**
- Toddlers with DS have delays in motivational development compared to children with typical development
- Children with DS have challenges self regulation, executive functions such as problem solving, task initiation & task persistence
- Reassessment time (3 weeks): test re-test reliability DMQ-18 measure 2 weeks interval

Study Limitations

A Carry Over Effect of the First Condition

- Either intervention or control might have impacted the results
- Children received high dosage of play & movement in an enriched environment in both conditions

Lack of Anonymous Assessors

- Each site investigator scored GMFM-88

Small Sample Size

- Pilot study
Conclusion

- The **effectiveness** of this harness system within an enriched play environment on gross motor development was evident
- Overall intervention positively affected gross motor development
- No statistically significant changes in children’s mastery motivation

**Implications:**
- Promising intervention for gross motor development for young children with DS

**Future Recommendations:**
- Replication: bigger sample size
- Include a harness & enriched play environment group, an enriched play environment only group, & a waitlist control group
Acknowledgements

• Participants & Families of children with DS
• McEwen Family Endowed Fellowship in Physical Therapy