Gross Motor Development Programming for Young Children with Visual Impairments

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Four Pillars
1. Leadership
2. Scholarship
3. Education
4. Program/Service
Mountain of Motor Development

- **Skillfulness** (11+ years)
- **Context-Specific Motor Skills** (7 years to 11 years)
- **Fundamental Motor Patterns** (1 year to ~7 years)
  - Examples of locomotor skill progressions: Running (2 years), jumping with both feet (28 months), galloping (2-3 years), hopping (3-4 years), skipping (4-7 years)
- **Preadapted Period** (2 weeks to ~1 year)
  - Rolls over (2 months), sits alone (4-8 months), pulls to stand (8 months), creeps (10 months), walks (15 months)
- **Reflexive Period** (Birth to 2 weeks)
  - Asymmetrical tonic neck reflex, doll-eye reflex, palmar grasping reflex, moro reflex, sucking reflex, Babinski reflex, rooting reflex, plantar grasping reflex, crawling reflex, stepping reflex, swimming reflex
Motor Milestones

- Voluntary, goal-directed movement
- Cortically controlled movements that, generally, follow predictable sequence
- Wide variation among individuals regarding when a particular skill will appear
- Take place in a cephalocaudal direction (aka head-to-toe)
- Each voluntary movement is a building block for subsequent movements
Infant Motor Milestone Sequence

- 2 months: Chin and chest up
- 5 months: Rolls over
- 6 months: Sits with support
- 8 months: Sits without support
- 10 months: Stands holding on
- 12 months: Pulls self to stood
- 14 months: Stands well alone
- 15 months: Walks well alone

Based on Shirley 1931
Locomotor and Posture
Motor Milestones

2 months: Lifts head in prone position

3 months: Lifts shoulders (turns head)
Locomotor and Posture
Motor Milestones

5 months: Rolls over, sits supported
Example: Rolling Over
Reaching and Grasping

Attainment of sitting allows the infant to reach, grasp, and manipulate objects

- Occurs rapidly over the first 8 months

- Challenging (and important) skills because the infant incorporates haptic and visual perception along with motor control and coordination of the arms

- Development of reaching emerges given a confluence of both intrinsic and extrinsic factors
Locomotion: The Three Cs

01 Crawling (begins around 34 weeks of age)
  • Sometimes skipped entirely
  • Torso in contact with the ground

02 Creeping (begins around 9 months of age)
  • Torso not in contact with the ground

03 Cruising (begins at 8-11 months of age)
  • Moving laterally while upright, using both arms for support
Early Locomotor Progression

- **~8 months**: Crawling
- **~9–12 months**: Creeping
- **10 months**: Cruising
- **12 months**: Walking alone
Bear Crawl

Stands alone & walks with assistance

Independent Walking
Motor Milestones in Children who are Blind

- Delays found in fine-motor skills, & locomotion.
- The delay in posture control from the lower level of motor stimulation due to the lack of sight and cognitive prerequisites
- Blind infants must replace visuomotor coordination with an audioproprioceptive coordination and control of movement, were still lacking at this age.
CHARGE Syndrome

CHARGE syndrome is a disorder that affects many areas of the body. CHARGE is an abbreviation for several of the features common in the disorder:

- Coloboma
- Heart defects
- Atresia choanae
- Restriction of growth
- Genital abnormalities
- Ear abnormalities
## Motor Milestones in Children with CHARGE Syndrome

Table 2.
Results of t-tests and means and standard deviations for age of motor milestone between children with and without CHARGE syndrome.

<table>
<thead>
<tr>
<th>Motor Milestone</th>
<th>CHARGE (N = 28)</th>
<th>Controls (N = 32)</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding head</td>
<td>8.68</td>
<td>5.01</td>
<td>2.32</td>
<td>1.42</td>
<td>5.29</td>
<td>20.81</td>
</tr>
<tr>
<td>Rolling over</td>
<td>10.05</td>
<td>3.40</td>
<td>3.87</td>
<td>2.00</td>
<td>6.21</td>
<td>28.43</td>
</tr>
<tr>
<td>Sitting w/o support</td>
<td>13.83</td>
<td>7.41</td>
<td>6.13</td>
<td>1.72</td>
<td>4.30</td>
<td>18.72</td>
</tr>
<tr>
<td>Crawling</td>
<td>16.19</td>
<td>5.85</td>
<td>7.61</td>
<td>2.56</td>
<td>5.42</td>
<td>20.05</td>
</tr>
<tr>
<td>Creeping</td>
<td>19.54</td>
<td>7.71</td>
<td>8.47</td>
<td>2.44</td>
<td>5.01</td>
<td>13.65</td>
</tr>
<tr>
<td>Standing with support</td>
<td>19.32</td>
<td>8.47</td>
<td>8.58</td>
<td>2.51</td>
<td>5.30</td>
<td>21.13</td>
</tr>
<tr>
<td>Standing w/o support</td>
<td>23.50</td>
<td>6.19</td>
<td>10.58</td>
<td>3.10</td>
<td>6.73</td>
<td>14.50</td>
</tr>
<tr>
<td>Cruising</td>
<td>22.39</td>
<td>10.21</td>
<td>10.76</td>
<td>2.46</td>
<td>4.71</td>
<td>18.87</td>
</tr>
<tr>
<td>Walking</td>
<td>26.27</td>
<td>6.44</td>
<td>12.42</td>
<td>2.34</td>
<td>6.88</td>
<td>11.55</td>
</tr>
</tbody>
</table>
Walking

- Development of independent walking is a complex task.
  - Muscles must be strong enough to support the body in an upright stance
  - Stable enough to allow balance shifts to occur.
- Children with VI are often 6 months or more delayed on independent walking (Haibach, et al., 2011)
- Children with CHARGE syndrome do not walk independently until 3 to 5 years of age (Hartsthorne, Hefner, Davenport, & Thelin, 2011; Hartsthorne et al., 2007).
Balance in Children with CHARGE

Haibach & Lieberman, 2013

- CHARGE Children (Mean 9.3 years SD 1.8 years)
- Controls - Average age began walking – 13.66 mths, SD 2.83 mths
- CHARGE – average age began walking 41.65 mths, SD - 17.35 mths
  14/ 22 fell in the last year
  14 indicated fear of falling
  9 used mobility aid
- Charge average PBS score (m 35.67; sd 14.69)
  12 of the 21 (57%) were at risk for falling
- Pbs was moderately correlated with abc scores (r = 0.56, p = 0.008)
Walking and Balance in Children with CHARGE Syndrome
Physical activity

- Very low activity levels – paq-c
  - Summary score mean 2.3

Balance

Motor Skills

Physical Activity
So what?

Balance, especially anticipatory control, plays an important role in fundamental motor skills of children with CHARGE syndrome.
Infants are acquiring motor milestones in a continuously growing and changing body.

Infants must learn to adapt their movements to their changing body.

Environmental affordances can change the acquisition of locomotor milestones.
## Gross motor chart for children with low vision

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Milestones</th>
</tr>
</thead>
</table>
| Birth to 3 months | Holds head steady while being moved  
Lifts head up when on belly  
Elevates self by arms when on belly (totally blind or LP only babies may not do this until after they roll from back to belly) |
| 4 to 6 months  | Sits with some support  
Rolls from belly to back, from back to belly  
Sits alone steadily  
Pulls to standing (while holding your hands)  
Moves forward through crawling, creeping, or any other method |
| 7 to 9 months  | Pulls self to sitting position  
Pulls to standing position (using furniture)  
Sits down  
Attempts to walk (while holding your hand)  
Creeps forward on hands and knees 3 feet or more  
Takes coordinated steps (while holding your hand) |
| 10 to 12 months | Stands alone  
Bends down to pick up object  
Walks sideways holding on to furniture  
Walks alone (3 steps)  
Walks alone with good coordination (5 steps)  
Pushes small obstacles out of the way  
Walks about house or yard independently |
| 13 to 15 months | Moves around large obstacle  
Walks up stairs with help, down stairs with help |
### Fine motor chart for children with low vision

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Milestones</th>
</tr>
</thead>
</table>
| Birth to 3 months | Plays with hands  
|               | Uses hands for purposeful action  
|               | Retains object placed in hand  
|               | Plays with toys that produce sound                                     |
| 4 to 6 months  | Reaches for object in contact with body with 1 hand (rather than 2)  
|               | Places objects in mouth  
|               | Uses pads of fingertips to grasp small objects  
|               | Transfers object from hand to hand  
|               | Brings object to midline  
|               | Pulls objects out of container                                         |
| 7 to 9 months  | Explores different textures  
|               | Places object in container  
|               | Pulls string to activate toy  
|               | Plays pat-a-cake                                                       |
| 10 to 12 months | Places one peg repeatedly into hole                                      |
| 22 to 24 months | Stacks large objects                                                    |
Infants Who Are At Risk

• Early and accurate identification of infants at risk for movement problems is of significant importance

• Delays in the presentation of well-designed early intervention programs is problematic for infants who are at risk

• Neural plasticity is maximally present during infancy and early childhood, thus magnifying the need for early intervention
Interventions for Infants Who Are At Risk

Key points

• Do the interventions have proven efficacy?
• Have we identified important outcomes?
• Do we have, and are we appropriately using, the right assessment tools?
• Is the intervention being carried out effectively and consistently?
Newell's Model Constraints
Individual

Experience

Visual impairment

Additional Disabilities

Modified Equipment

Task

Activities

Instructional strategies

Environment

Parental shielding

Limited MD knowledge

Lack of opportunities
Home Environment

Beach et al. (2021)

- Parents of young children with and without CHARGE syndrome aged 18-42 months

- Purposes: 1) to explore and describe the home environment from parents of very young children with CHARGE Syndrome and 2) compare these results to the home environment of typically developing children.
Affordances in the Home Environment for Motor Development

Outside Space
- Inside Space
- Variety of Stimulation
- Fine Motor Toys
- Gross Motor Toys
Participants with CHARGE acquired motor milestones, such as standing and age of independently walking, significantly later than their peers without disabilities.

The groups only differed on outside space suggesting that parents of children without disabilities offer better outside space affordances than the parents of children with CHARGE.

Age of walking for children with CHARGE syndrome was positively correlated with outside space \((r_s = .63, p = .038)\), fine motor toys \((r_s = .70, p = .016)\), gross motor toys \((r_s = .84, p = .001)\), and total AHEMD \((r_s = .88, p < .001)\).
Importance of Home Environment

Results reveal the importance of home affordances in child motor development.

Motor skill development has an interactive effect with cognitive, emotional, and motor-perceptual development (Haydari, et al., 2009).

Home environment resources include toys and space, but also parental and family support such as encouragement, guidance, and regular engagement with their child.
Task & Environmental Strategies
Using Constraints to Design Developmentally Appropriate Movement Activities

- **Task**
  - Bright Colored Balls and Toys
  - Toys with sound
  - Music

- **Environment**
  - Nonslip surface
  - Instructional Strategies
  - Parental Involvement
  - Rich Environment
  - Social interaction
Task (toy) Considerations

- Safety – Babies with low vision mouth toys more often
- Simple is often best
- Focus on textures, sounds, and high contrast
- Promotes manipulation or movement
Instructional Strategies
Encouraging Crawling

Progression 1 – Age 3-6 months

• Place on all tummy, with infant holding up on arms, push feet up to encourage them to push with feet

Progression 2 – Age 6-9 months

• Place infant on all fours supporting them under chest as they move forward
• Strengthens shoulder and neck
Crawling Assistance

Progression 3 – Age 6-9 months
- Place a hand towel around infant's torso
- Trains sensory and motor skills
- Option 2 – wheelbarrow; trains shoulder, arm, and neck

Progression 4 – Age 6 to 12 months
- Place a bright colored and/or auditory toy a couple of feet ahead of them
Share challenges and tips
Independent Walking Tips

Minimize holding hands
- We won't let them fall
- Preventing them from using their hands
  - Challenges standing and walking balance progressions
- Encourages them to lean forward
- Encourages them to walk too quickly to keep up
- Once begun, infants will want to continue to do so
Encouraging Walking

1 - Place folded towel across chest under armpits; place motivator in front of infant

2 – walking with broom handle for your child to hold; push the broomstick slightly forward to encourage stepping

3 – Cruising between chairs

4 – Walking to you

5 – Walking using a baby walker

6 – Independent walking – sometimes walking with toys/ objects in hands can help
Balance Activities
Resources
Books, Websites, Videos
Gross Motor Development Curriculum
for Children With Visual Impairment

Lauren J. Lieberman and Pamela S. Haibach

Gross Motor Development Curriculum & Video
Websites

• The American Printing House for the Blind
  • Books, products, equipment, and videos
  • www.aph.org/pe

• Camp Abilities-educational sports camps for children who are visually impaired or deafblind
  • Includes videos and web sites for other camps around the world
  • www.campabilities.org (Instructional Materials)

• Perkins School for the Blind
  • Videos and books about how to teach children who are deafblind
  • www.Perkins.org
Thank you for attending!