Wearable Canes Improve Motor, Concept, Language, & Social Skills

Presented by
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Power Point Content

Slide 1: Wearable Canes
Improve motor, concept, language and social skills
Dr. Grace Ambrose-Zaken, COMS
Founder Safe Toddlers
With gratitude to Safe Toddlers Co-Founder Biomedical Engineering professor Marom Bikson and Lead Engineer Mohamad FallahRad

Slide 2: Has anyone here ever said
• Not moving is worse than moving with collisions?

“Do not too much regard bumps upon the forehead, rough scratches or bloody noses; even these may have their good influences. At the worst, they affect only the bark, and do not injure the system like the rust of inaction” (Buell, 1962, p. 65).

Slide 3: Has anyone here ever said
In the 1930s Dr. Thomas Cutsforth, a prominent psychologist whose classic work The Blind in School and Society wrote, “when the child (who is blind or visually impaired) has once learned to walk, it is well to omit any form of manual guidance about the house and to permit the child to become oriented himself, even at the expense of minor injuries and emotional distress of both the child and the other members of the family” (p. 21-22).

Slide 4: Has anyone here ever said
In 1956, renowned educator of the visually impaired Berthold Lowenfeld recommended that “young children (who are blind or visually impaired) must learn to walk without help of any kind in familiar territory. What is familiar territory expands as they grow older, until they learn to venture out into places that are new to them. When the time comes to do this, they should learn to use the cane. Usually this is found practical only after a youngster is fourteen years of age, more often older than that” (p. 187-188).
• Have you ever said something similar to a family?

Slide 5: Motor skill delays are inevitable in MVI
• Bakke, et al., (2019) reviewed 1113 articles on motor skills with visual impairment. “...motor development in children with visual impairment is expected to be different from that in typically developing peers” (p. 1).
• Studies focused on changing the environment and/or offering adapted physical therapy training to address the motor skill impact on this population.
Slide 6: Motor skill delays are inevitable in MVI

• None of the research reviewed sought to declare these motor skill deficits as, avoidable.
• Instead, researchers overwhelmingly agreed that severe visual impairment and blindness resulted in motor skill delays due to a lack of anticipatory preview of the environment, and nothing had been found that can prevent these “inevitable motor skill delays” observed in children who are congenitally blind and visually impaired.

Slide 7: Poor motor skill development

• Slow pace,
• Halting, protective gait
• Delay in walking free of an adult’s hand
• Bruises from colliding with unseen obstacles

Wyver and Livesey (2003) review of motor skill research on children with visual impairment concluded, “…findings are generally consistent despite the studies being conducted in a wide range of settings, in a variety of countries and with children with varying degrees of visual disability... there is strong evidence of an adverse impact of visual impairment on motor development”

Slide 8: What do bruises teach?

• Skellenger and Sapp (2010) wrote that “a major overriding role of O&M specialists working with learners in the early childhood years will be the facilitation of the child’s typically innate enjoyment of exploration, which is so often thwarted by absent or impaired vision” (p. 168).

• The role of the practitioner was to continue with enrichment activities until such time as these students with visual impairment demonstrated “higher developmental skills that indicate readiness to begin long-cane instruction” (p. 190) and lack of competence with the long cane was considered probable through age five.

Slide 9: Where is the logic in early intervention for VI?

Is it logical?

‘because blind toddlers are unable to physically and cognitively use the long cane correctly to achieve consistent tactile path information, that they benefit from collisions.’

‘When they are able to use the long cane, they no longer benefit from collisions.’

This is not logical, because everybody needs path information to move about safely, especially children aged five and younger.

Slide 10: No one benefits from collisions

• No one benefits from collisions
• No one benefits from collisions
• There is no benefit from collisions
• Collisions can benefit sighted kids – not blind kids.
Slide 11: How far are they behind?

- Rosen stated that children born severely visually impaired or blind were typically 3-6 months behind in gross motor skill development, and reasons for delays included "...apprehensions about moving in space without vision."
- The concern, Rosen explained, was that gross motor skills, "the ability to move about and explore is essential to global development and forms the foundation for cognitive development."

Slide 12: On target or not?

- Family report on 15 months old – ONH don’t know if she had light perception
  She’s cruises around the house and is very mobile. She does this following walls or walking while pushing toys. She has a very good sense of her surroundings but I think she is afraid to walk without having that security of holding onto something. She will walk across a room unaided following a voice, but is scared.
- We don’t know of any learning disabilities, but she is still non verbal

Slide 13: On target or not?

- Professional report on 24 months old – blind
  o On target w/gross motor. Gets scared walking outside
  o Delayed speech
  o Push toy: shopping cart
- When left to play on own?
  o Explores everything
- Reason for WWC?
  o Increase confidence walking (especially outside and in crowds); Build concepts; Work on running

Slide 14: On target or not?

- Family report on 38 months old – CVI
  o My son is able to walk however he will fall or hit is head of something is in front of him He easily runs into doors and walls. Trips over planters and steps on his younger sibling.
  o No mobility device
- When left to play on own?
  o Run into walls when overly excited and just walk and explore around.
- Reason for WWC?
  o I think this cane will allow him to be more comfortable when he is outside. At this time he is constantly hunched over and turns his foot outwards and lets it slide across the ground when walking I think the cane will help stop that feature and feel more comfortable with his low vision.
Watch as 2 year 4 month old child uses her cane to navigate, probe and learn what is in her world. Toddlers can and should be introduced to canes even before they start walking.

You will see she does not just push a cane (as my students used to do with the heavier canes with rolling tips, which they tended more to drop or toss as they did not understand the vital information they could provide). The lighter cane enables her to actually probe to touch and identify objects in her environment. For more information on can usage with preschoolers contact alliedva@aol.com

https://www.youtube.com/watch?v=rIGN44XJ7bY&t=278s

We Are Unique for a Reason 3 years ago
I’m full of tears of joy god bless these children

Images above show thumbs up and thumbs down images along with the word “Reply”

James eddington 2 years ago
What a sweet Angel god Bless little one

Images above show thumbs up and thumbs down images along with the word “Reply”
Slide 16: Developmental Milestones: Gross motor

Figure 2 Graphic - see explanation below.

Explanation of graphic: two tables appear on the page with an arrow moving from the right-hand table to the left-hand table. Each of the age groups (by months) are circled. In the right-hand table these additional phrases are underlined: 15 months – Walking alone, feet wide, 18 months – but cannot avoid, and 2 years – avoiding obstacle.

**Left-hand table – 2 Mobile phase**

**9 months**
- Rolling
- Squirming
- Attempts to crawl
- When held, steps with alternate feet

**12 months**
- Cruising
- Crawling, bottom shuffling, creeping or bear walking

**Right-hand table – 3 Highly mobile phase**

**15 months**
- Walks alone, feet wide, arms up, often falls, bumps into furniture
- Stands from sitting w/out support

**18 months**
- Walks well with arms down
- Start n stop safely
- Runs carefully, but cannot avoid obstacle

**2 years**
- Runs avoiding obstacle
Figure 3 Complex graphic contains bar graph with the following information (see below)

Age of child (months) by current demonstrated motor skill milestone before wearable cane (n=155)

- Vertical axis – Frequency 0.0 – 40.0
- Horizontal axis – Age of child (months) 0-180 months

Motor skill milestones key

- Blue 10 months – stands
- Red 11 months – cruises
- Green 12 months – walks with assistance
- Orange 15 months – walks wide-based gait, cannot avoid obstacles
- Yellow 18 months – walks well, runs cannot avoid obstacles
- Turquoise 24 months – runs able to avoid obstacles

10 months – Stands – Mean=34.2308, Std. Dev.=26.768, N=14
11 months – Cruises – Mean=28.5714, Std. Dev.=14.62724, N=14
12 months – Walks well with assistance – Mean=44, Std. Dev.=25.55242, N=64
15 months – Walks wide-based gait, cannot avoid obstacles – Mean=38.8448, Std. Dev.=22.91158, N=58
18 months – Walks well, runs cannot avoid obstacles – Mean=34.40, Std. Dev.=20.28053, N=5
24 months – Runs, able to avoid obstacles – Mean=25, Std. Dev. = , N=1
Slide 18: Relationship to child by attained motor milestone before wearable cane

![Complex bar graphic: see explanation below.](image)

**Figure 4 Complex bar graphic: see explanation below.**

**Vertical axis – Count**

**Horizontal axis – Relationship to child, three bars represent from left to right: professional, family, not stated**

**Motor skill milestone key**

- Blue 10 months – stands
- Red 11 months – cruises
- Green 12 months – walks with assistance
- Orange 15 months – walks wide-based gait, cannot avoid obstacles
- Yellow 18 months – walks well, runs cannot avoid obstacles
- Turquoise 24 months – runs able to avoid obstacles
Slide 19: Age of child (months) by learning ability before wearable cane (n=68)

Figure 5 Complex bar graph: see explanation below.

Vertical axis – frequency (0-15)
Horizontal axis – age of child (months) from 0-132

Learning ability key
- Blue – non-specific comments
- Red – Intellectually disabled
- Green – developmentally delayed
- Orange – within normal limits

Non-specific comments – Mean=37.0833, Std. Dev.=27.79947, N=12
Intellectually disabled – Mean=58.3077, Std. Dev.=33.12951, N=13
Developmentally delayed – Mean=41.00, Std. Dev.=18.56206, N=41
Within normal limits – Mean=20.50, Std. Dev.=7.77817, N=2
Slide 20: Relationship to child by learning ability before wearable cane

Figure 6 Complex bar graph: see explanation below.

**Relationship to child by learning ability (N=204)**

Vertical axis = Count (0-40)

Horizontal axis = Relationship to child (left to right: professional, family, not stated).

**Learning ability key**

- Blue – non-specific comments
- Red - Intellectually disabled
- Green – Developmentally delayed
- Orange – Within normal limits
**Slide 21: Motor milestone by learning ability before wearable cane**

**Gross motor milestone by learning ability before wearable cane**

- **Learning ability**
  - Blue – non-specific comments
  - Red - Intellectually disabled
  - Green – Developmentally delayed
  - Orange – Within normal limits

**Motor skill milestone by learning ability**

Horizontal axis – motor milestone includes from left to right:
- Blue 10 months – stands
- Red 11 months – cruises
- Green 12 months – walks with assistance
- Orange 15 months – walks wide-based gait, cannot avoid obstacles
- Yellow 18 months – walks well, runs cannot avoid obstacles
- Turquoise 24 months – runs able to avoid obstacles

**Learning ability key**
- Blue – non-specific comments
- Red - Intellectually disabled
- Green – Developmentally delayed
- Orange – Within normal limits
Figure 8 complex bar graph: see explanation below.

**Age of child (months)**

Vertical axis – frequency (0-20)

Horizontal axis – age of child (months) 0-132

**Activities on own key**

- Blue – crawls around
- Red – stay in on location
- Green – walks around (bumps into stuff)
- Orange – explores everything
- Yellow – always by me
- Turquoise – cannot be left alone
- Pink – hits self, becomes angry frustrated
- Purple – climbs on furniture, cruises

Crawls around – Mean=46.4375, Std. Dev.=31.57207, N=16
Stay in on location – Mean=46.70, Std. Dev.=24.60327, N=30
Walks around (bumps into stuff) – Mean=31.50, Std. Dev.=14.64319, N=14
Explores everything – Mean=24, Std. Dev. = , N=1
Always by me – Mean=54, Std. Dev. = , N=1
Cannot be left alone – Means=34.00, Std. Dev.=28.28427, N=2
Hits self, becomes angry frustrated – Mean=62.00, Std. Dev. = , N=1
Climbs on furniture, cruises – Mean=27.4286, Std. Dev. =9.14435, N=7
Slide 23: Relationship to child by solitary play skills before wearable can

Figure 9 complex bar graph: see explanation below.

Relationship to child by activities when left to play on own
Vertical axis – count (0-40)
Horizontal axis – Relationship to child – three bars from left to right: professional, family, not stated

Activities key
- Blue – crawls around
- Red – stay in on location
- Green – walks around (bumps into stuff)
- Orange – explores everything
- Yellow – always by me
- Turquoise – cannot be left alone
- Pink – hits self, becomes angry frustrated
- Purple – climbs on furniture, cruises
Slide 24: Age of child (months) by type of mobility device before wearable cane (n=170)

Figure 10 Complex bar graph: see explanation below.

Age of child (months by type of mobility device (n=169)
Vertical axis – frequency (0-40)
Horizontal axis – age of child (months) from 0-180

Type of mobility device key

- Blue – homemade AMD
- Red – PT device (walker, gait trainer, AFOs)
- Green – long cane
- Orange – none
- Yellow – push toy
- Turquoise – adapted long cane
- Pink – toddler cane (wearable)
- Purple – baton, brush

Homemade AMD – Mean=30.00, Std. Dev.=9.4163, N=4
PT Device (walker, gait trainer, AFOs) – Mean=54.4783, Std. Dev.=28.24366, N=23
Long Cane – Mean=39.6842, Std. Dev.=20.46963, N=19
None – Mean=39.5138, Std. Dev.=26.0788, N=109
Push Toy – Mean=32.2308, Std. Dev.=17.46975, N=13
Toddler cane (wearable) – Mean=47.00, Std. Dev.= , N=1
Baton, brush – Mean=54.00, Std. Dev.= , N=1
Slide 25: Relationship to child by type of mobility device before wearable cane

Figure 11 Complex bar graph: see explanation below.

Relationship to child by type of mobility device

Vertical axis – Count (0-100)
Horizontal axis – Relationship to child from left to right: professional, family, not stated

Type of mobility device key
• Blue – homemade AMD
• Red – PT device (walker, gait trainer, AFOs)
• Green – long cane
• Orange – none
• Yellow – push toy
• Turquoise – adapted long cane
• Pink – toddler cane (wearable)
• Purple – baton, brush
Slide 26: The PT Device fix…

- She just received orthotics in her shoes yesterday - she seems to have increased stability with these.
- Her physiotherapist wants us to wait before offering a non-weight bearing device.
- 28 months – tunnel vision - Traveling independently is a major concern, he learned to walk when he turned two last October, but does not notice obstacles, even ones that are consistent in his own home. He trips over the step going from inside to outside of his home every time. He does not notice drop offs such as the sidewalk or even the steps in his own home. This is a major safety concern.

Slide 27: Age of child (months) by why requesting wearable cane (n=80)

![Complex bar graph. See explanation below.](image)

**Vertical axis – Frequency (0-20)**

**Horizontal axis – Age of child in months (0-132)**

**Why wearable cane key**

- Blue: Current tool not working
- Red: For independence & confidence
- Green: Professional recommendations
- Orange: To develop motor skills
- Yellow: To prevent child collisions

Current tool not working – Mean=43.00, Std. Dev.=23.47765, N=16
For independence & confidence – Mean=42.3214, Std. Dev.=29.20433, N=28
Professional recommendations – Mean=31.60, Std. Dev.=9.42338, N=5
To develop motor skills – Mean=36.5833, Std. Dev.=19.77353, N=12
To prevent child collisions – Mean=47.5263, Std. Dev=20.60304, N=19

**Slide 28: Relationship to child by why requesting wearable cane**

*Figure 13 Complex bar graph. See explanation below.*

- **Vertical axis** – Count (0-40)
- **Horizontal axis** – Relationship to child: three bars from left to right: professional, family, not stated

**Why wearable cane key**
- Blue – Current tool not working
- Red – For independence & confidence
- Green – Professional recommendation
- Orange – To develop motor skills
- Yellow – To prevent child collisions

**Slide 29: Mobility visual impairment**

When walking or running, the inability to visually avoid obvious obstacles
### Slide 30: Preverbal MVI assessment

<table>
<thead>
<tr>
<th>A. Affect</th>
<th>Visible signs of emotional state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Hand position when locomoting</td>
</tr>
<tr>
<td>1</td>
<td>Hand aggression (eye poking, punching, hitting self/others)</td>
</tr>
<tr>
<td>2</td>
<td>Hands held mid body to near head, arms bent</td>
</tr>
<tr>
<td>3</td>
<td>Hands held at sides, long straight arms</td>
</tr>
<tr>
<td>4</td>
<td>Arm swing; can manipulation</td>
</tr>
<tr>
<td>5</td>
<td>Appropriate to developmental potential</td>
</tr>
</tbody>
</table>

### Slide 31: Video demonstrating MVI affect

### Slide 32: Preverbal MVI assessment

<table>
<thead>
<tr>
<th>B. Motor</th>
<th>Observable moving about the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Self-generated relocation efforts</td>
</tr>
<tr>
<td>1</td>
<td>Stationary; no attempt to relocate</td>
</tr>
<tr>
<td>2</td>
<td>Moves arms and trunk only</td>
</tr>
<tr>
<td>3</td>
<td>Constant contact with objects</td>
</tr>
<tr>
<td>4</td>
<td>Walks across/standing open space</td>
</tr>
<tr>
<td>5</td>
<td>Appropriate to developmental potential</td>
</tr>
</tbody>
</table>

### Slide 33: Video demonstrating MVI motor

### Slide 34: Preverbal MVI assessment

<table>
<thead>
<tr>
<th>C. Cognition</th>
<th>Demonstration of intellect and concept awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Ability to communicate wants, needs and thoughts to others</td>
</tr>
<tr>
<td>1</td>
<td>Quiet</td>
</tr>
<tr>
<td>2</td>
<td>Verbalizations</td>
</tr>
<tr>
<td>3</td>
<td>Babbling; echolalia</td>
</tr>
<tr>
<td>4</td>
<td>Purposeful communication</td>
</tr>
<tr>
<td>5</td>
<td>Appropriate to developmental potential</td>
</tr>
</tbody>
</table>
Slide 40: Prefer Sedentary lifestyle
- No child five and younger prefers sedentary lifestyle – the arrive at the conclusion that the best, safest, least painful way to exist is to avoid moving.
- No child prefers to be passive

Slide 41: Unknown reason for gross motor delays
- The reason for gross motor delays is lack of consistent path information.
- Mobility visual impairment and blindness robs children of their path information.
- When worn everyday most of the day, wearable canes provide consistent tactile path information.

Slide 42: When we finally provide them with CTPI
- They run
- They explore
- They begin speaking
- They show joy
- They begin to trust
- There may be crying – but just like a seat belt- they don’t get a vote when it comes to safety for their own good.
Texas School for the Blind & Visually
Outreach Program

Figure 14 TSBVI logo

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