THE EFFECT OF DIFFERENT WALKING DEVICES ON BODY FUNCTIONS, ACTIVITY AND PARTICIPATION IN CHILDREN WITH CEREBRAL PALSY; A SYSTEMATIC LITERATURE REVIEW

1. Description and classification of assistive devices that facilitate walking

2. Evidence of the impact the different devices have on
   - Body structure and function
   - Activity and Participation

Definition

A device that uses the residual capacity of the child to stand and walk and assists in standing, balance and locomotion by:
- increasing the base of support
- reducing the load on the affected limbs
- providing sensory information
- reducing the deviation of the center of gravity

(provided by Fas A et al., 1995)
- providing actuated movements of the legs to support or replace self-initiated movements

Classification

<table>
<thead>
<tr>
<th>Handheld Walkers</th>
<th>Gait Trainers</th>
<th>Robotic Devices</th>
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<td>Static</td>
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<td>Overground</td>
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<td>Walking systems</td>
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<td>Wearable</td>
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<td>Exoskeleton</td>
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</table>
Method: systematic literature study

EFFECT OF DIFFERENT WALKING DEVICES

Inclusion criteria: Cerebral Palsy, 0–18 Y, GMFCS I–V, walking aids, walking devices
Excluded: Non CP, >18 Y, Systematic Reviews

Date: Jan 1990 – March 2019 Published, Web, Embase, Cochrane

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
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<tbody>
<tr>
<td>TRUNK AND PELVIS MOVEMENTS DURING GAIT, WITH AND WITHOUT EXTERNAL CONTROL</td>
<td>EFFECT ON KINEMATICS OF THE GAIT PATTERN</td>
<td>EFFECT ON HAND FUNCTION, (HAND) ACTIVITIES AND PARTICIPATION</td>
</tr>
<tr>
<td>11 studies</td>
<td>12 studies</td>
<td>11 studies</td>
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</table>

Study 4 Synthesis

EVIDENCE OF THE IMPACT THE DIFFERENT DEVICES HAVE ON BODY STRUCTURE AND FUNCTION, ACTIVITY AND PARTICIPATION

44 studies

Method: search flowchart

Articles identified (n=1838)

Articles excluded based on abstract or title (n=1541)

Potentially relevant articles remained (n=73)

Articles excluded (n=29)

Not CP patients

Not in English

Full text and/or abstract not available

Not relevant for this search

Results: handheld walkers

Comparison of anterior and posterior walkers:

- Bachschmid et al. 2005: AW, PW: gait, orientation
  - Spastic CP: increased double limb support time (24.0%–30.7%) with PW compared to AW
  - Non-spastic CP: no significant difference
  - No difference in gait speed and cadence

- Logan et al. 2008: PW and AW
  - PW: 2.5% decrease in double support time and 1.7% decrease in swing time with PW
  - AW: 1.3% increase in double support time and 0.8% decrease in swing time

- Mattsson et al. 2007: PW and AW
  - No significant difference in gait speed, stride length, double support time, and gait efficiency
  - PW: higher gait speed and stride length

- Park et al. 2008: PW and AW
  - Gait pattern and energy consumption
  - PW: increased energy consumption and decreased walking speed
  - AW: decreased energy consumption and increased walking speed

- Spafford et al. 2008: PW and AW
  - Energy expenditure, walking speed, and gait pattern
  - PW: higher energy expenditure
  - AW: lower gait speed and reduced gait pattern

- Level of evidence

- Level 1: Randomized clinical trial
  - Level 2: Non-randomized clinical trial
  - Level 3: Observational study
  - Level 4: Case series
  - Level 5: Expert opinion
### Results: gait trainers

#### Partial Bodyweight Support

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Study Type</th>
<th>Intervention</th>
<th>Group</th>
<th>Conclusions</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botto et al.</td>
<td>2013</td>
<td>Cross-over</td>
<td>Walking aid with partial bodyweight</td>
<td>CP</td>
<td>Improved trunk &amp; pelvis muscle strength</td>
<td>IV</td>
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<td>support (WAS)</td>
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<tr>
<td>Pescia et al.</td>
<td>2017</td>
<td>Case study</td>
<td>Hip brace + knee strap</td>
<td>CP</td>
<td>Decreased trunk &amp; pelvis muscle strength</td>
<td>V</td>
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<td>King et al.</td>
<td>2013</td>
<td>Qualitative</td>
<td>Hartman walker; parent interview</td>
<td>N=19</td>
<td>Better communication, more independent, better participation</td>
<td>V</td>
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<td>Study</td>
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<td>Whinnery et al.</td>
<td>2002</td>
<td>Randomized</td>
<td>Riffon pacer</td>
<td>N=1</td>
<td>Increased number of steps</td>
<td>V</td>
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<td>Study</td>
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<td>Willoughby et al.</td>
<td>2010</td>
<td>RCT</td>
<td>To compare overground walking</td>
<td>N=34</td>
<td>No significant difference; trend towards</td>
<td>Ib</td>
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<td>Study</td>
<td>and walking in gait trainer</td>
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<td>increased distance in over ground</td>
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<tr>
<td>Wright et al.</td>
<td>2016</td>
<td>Cohort</td>
<td>Look for improvement of activity</td>
<td>N=19</td>
<td>Change in walking speed and GMFCS II</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Study</td>
<td>(gait, participation) using the Hartman walker</td>
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### Conclusions study trunk & pelvis control

1. Trunk tilt and obliquity, pelvis tilt, spine obliquity, kyphosis and lordosis of the increased in children with CP.
2. The range of motion gets higher when the GMFCS-level increases.
3. Movements of the lumbar spine are higher in CP-children.
4. Because of these bigger ranges, children with CP use their muscles less effectively and for that reason they need more muscle activity → higher energy consumption + bigger forces on the lower spine.
5. Trunk extension is less when supported by crutches + anterior pelvic tilt ROM is bigger.
6. When external control given by an AW or PW, the ROM of the pelvis is higher.
Final Conclusions: nothing is final

- Wide diversity of walking aids
- Heterogeneity of population: different external and personal factors
- Most studies are dealing with body functions
- Almost no studies on participation: what about outside the therapy room?
- Significant effects on activity = ?
- Small sample studies
- Low level of evidence

Need for:
- Study effect on activity and participation as well
- N=1 studies with broad outcome variables and documenting all ICF components
- Larger samples
- Multicenter
- Longer term intervention
- Control groups

Thank you

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