Treadmill Training in Children with Down Syndrome

Sarah Bowley, Morgan Yoder, Jasmine Charpentier
PICO Question

Is treadmill training effective in working with children with Down Syndrome to improve delayed gait patterns?

What is Down Syndrome (DS)

- Genetic disorder: chromosome 21\(^{(1,2,3)}\)
- 1/800 births in U.S. \(^{(1,2,4)}\)
- Most common cause of cognitive deficits in children \(^{(1)}\)
- Common Symptoms \(^{(2,3)}\)
  - Intellectual disability
  - Delays in speech
  - Hypotonia
  - Delayed & uncoordinated motor development

Effects of DS on Gait \(^{(1, 3, 5)}\)

- Delayed independent walking
- Slower walking speed
- Shorter stride length
- Wider step width
- Decreased propulsion

Current Treadmill Interventions

• Recent benefits of treadmill training on gait for children with DS (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

• Why treadmill training? (7)
  – Elicits stepping pattern
  – Can be used with preambulatory infants
  – Task-specific
  – Promotes neuroplasticity
Methods

- Databases: EBSCOhost, PubMed, Google Scholar

- Terms:
  - Down Syndrome
    - EBSCOhost: 39,486, PubMed: 32,588, Google Scholar: 2,710,000
  - Down Syndrome treadmill training
    - EBSCOhost: 57, PubMed: 43, Google Scholar: 23,200
  - Down Syndrome Gait
    - EBSCOhost: 297, PubMed: 152, Google Scholar: 74,700
  - Down Syndrome Delayed walking
    - EBSCOhost: 6, PubMed: 10, Google Scholar: 76,300
  - Low tone treadmill training
    - PubMed: 11, Google Scholar: 26,500
Research Synthesized

• 10 articles were chosen based on:
  – Relevance
  – Recent
  – High level of evidence

• 1A: 2 Systematic Reviews of RCT
• 1B: 7 RCT
• 2B: 1 Cohort Study
Results

• Earlier walking onset with home treadmill training$^{(1, 6)}$

• High intensity, specific treadmill training had more improvements when compared with low intensity, general treadmill training $^{(1, 2, 3, 4, 5, 7, 8)}$
  – Earlier walking onset $^{(7, 8)}$
  – More advanced gait patterns $^{(1, 4, 5, 8)}$
  – More developed joint kinematics $^{(5)}$
  – Earlier development of obstacle avoidance strategies $^{(3)}$
  – Higher physical activity levels $^{(2)}$
  – Earlier attainment of motor milestones$^{(1)}$
Results Continued

• Treadmill training vs. suspension overground therapy \(^{(9)}\)

• Systematic review showed level II evidence that treadmill training for infants with DS improved: \(^{(10)}\)
  – Velocity, cadence, stride/step length, percent double limb support, foot rotation, asymmetry, step width, dynamic base, onset of standing, onset of walking 3 steps independently
Discussion

- Improves gait compared to no treadmill training
- Specific to patient and high intensity
- Can be administered at home
- Suspension overground therapy

- **Answer to PICO question:** Yes, treadmill training is effective in improving delayed gait patterns in children with DS
Areas for Future Research

- Effects of treadmill training ($2, 10$)
- How treadmill training should be implemented ($6, 10$)
- Larger sample size ($8$)
- Strategies for maintaining gains ($2$)
- Effects in different contexts, populations, and cultures ($3$)
- EMG studies ($5$)
References