Effectiveness of Gait Interventions in Improving Gait in Adults with Ataxia: A Systematic Review

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Overview

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- Purpose
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- Acknowledgements
Background

Ataxia:

- Lack of coordination characterized by progressive disturbances related to balance and gait
- Often caused by acquired brain injury (TBI, CVA or infection) or degenerative cerebellar changes¹,²

Background

• Traditionally, patients with ataxic gait have been treated using compensatory strategies such as ankle weights/weighted vests, or using assistive devices\(^3\)
  • Although widely used in everyday practice, there is no significant research on the efficacy of these strategies\(^4\)

• There has been no consensus on the best intervention to improve ataxic gait\(^4\)
Purpose

• The purpose of this study was to determine the most effective gait intervention in improving gait in patients with ataxia.
Methods

Databases

• CINAHL
• Health Source: Nursing/Academic Edition
• MEDLINE/PubMed
• Proquest
• Hand search

Search Limits

• Last 10 years 2008-2018
• English
• Human subjects
• Scholarly (Peer-Reviewed) articles
Search Terms

(ataxia) AND ("gait training" or "locomotion training" or "gait rehabilitation")
Selection Criteria

- **Diagnosis:** ataxia
- **Age:** adult (18 or older)
- **Gender:** male or female
- **Outcomes:** objective gait measurements
  - Having an outcome measure with a gait component
- **Intervention:** any *gait* intervention
  - A gait rehabilitation strategy that directly involves ambulation or pre-ambulation
  - Balance training alone was not considered a gait intervention
Records identified through database searching (n=55)

Additional records identified through other sources (n=1)

Records identified after duplicates removed (n=48)

Records screened (n=48)

Studies included in qualitative synthesis (n=9)

Records excluded (n=35):
- Not gait/lack of gait outcome measure (n=8)
- Not ataxia (n=13)
- No intervention/wrong design (n=12)
- Not adult (n=1), not humans (n=1)

Full text articles excluded (n=4):
- Not ataxia (n=1)
- Lack of objective gait outcome measure (n=3)
<table>
<thead>
<tr>
<th>Article Title</th>
<th>Sackett Level</th>
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</thead>
<tbody>
<tr>
<td>A Comparative Study of Conventional Physiotherapy versus Robot-Assisted Gait Training Associated to Physiotherapy in Individuals with Ataxia after Stroke.</td>
<td>1B</td>
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<tr>
<td>The effect of a task-specific locomotor training strategy on gait stability in patients with cerebellar disease: a feasibility study.</td>
<td>4</td>
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<tr>
<td>Partial Body Weight-Supported Treadmill Training in Spinocerebellar Ataxia.</td>
<td>4</td>
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<tr>
<td>Gait adaptability training improves obstacle avoidance and dynamic stability in patients with cerebellar degeneration.</td>
<td>4</td>
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<tr>
<td>Use of trunk stabilization and locomotor training in an adult with cerebellar ataxia: A single system design.</td>
<td>5</td>
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<tr>
<td>Challenge-oriented gait and balance training in sporadic olivopontocerebellar atrophy: a case study.</td>
<td>5</td>
</tr>
<tr>
<td>Delayed regaining of gait ability in a patient with brain injury: A case report.</td>
<td>5</td>
</tr>
<tr>
<td>Metronome Cueing of Walking Reduces Gait Variability after a Cerebellar Stroke.</td>
<td>5</td>
</tr>
<tr>
<td>Treadmill training for ataxic patients: A single-subject experimental design.</td>
<td>5</td>
</tr>
</tbody>
</table>
Results

- **Samples Ranged:** 1-19 participants (58 total)
- **Intervention parameters:** 1-60 sessions lasting 10-240 minutes
- **Duration of the interventions:** 1 day-20 weeks
Results

Interventions included:

- Treadmill training$^{1,2}$
- Partial body weight support$^{3-5}$
- Dynamic gait training$^7$
- Auditory cueing$^9$
- Conventional gait training$^{6,8}$

Results

All 9 studies found statistical and/or clinical improvements in gait outcomes such as:

- **Spatio-temporal gait parameters** (cadence, step length/width, gait speed, etc.)\(^2,3,6,7,9\)
- **Complex gait** (Timed Up and Go test, Dynamic Gait Index)\(^2,4,5,7\)
- **Ataxia** (Scale for Assessment and Rating of Ataxia)\(^1,5,8\)
- **Independence** (Functional Ambulation Category)\(^3,8\)
- **Gait quality** (Rivermead Visual Gait Assessment)\(^2\)
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Sample Size</th>
<th>Intervention Parameters</th>
<th>Duration</th>
<th>Outcomes Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot assisted gait training vs. therapist assisted gait training(^5)</td>
<td>N=15</td>
<td>60 min 3x per week</td>
<td>5 months</td>
<td>Complex gait (TUG), Ataxia (SARA)</td>
</tr>
<tr>
<td>Conventional gait training (with weight shifts, verbal cuing, etc.)(^6)</td>
<td>N=19</td>
<td>1.5 hrs 2x per week</td>
<td>12 weeks</td>
<td>Spatio-temporal gait parameters (COM displacement, gait speed, step length/width, stance time)</td>
</tr>
<tr>
<td>Partial Body Weight Support(^4)</td>
<td>N=8</td>
<td>50 min 2x per week</td>
<td>18 weeks</td>
<td>Complex gait (DGI)</td>
</tr>
<tr>
<td>Treadmill training (with visual cues)(^1)</td>
<td>N=10</td>
<td>1 hrs 10 sessions</td>
<td>5 weeks</td>
<td>Ataxia (SARA)</td>
</tr>
<tr>
<td>Conventional gait training (with trunk stabilization)(^3)</td>
<td>N=1</td>
<td>60-90 min 28 sessions</td>
<td>22 weeks</td>
<td>Spatio-temporal gait parameters (10 MWT), Independence (FAC)</td>
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<tr>
<td>Intervention</td>
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<td>Intervention Parameters</td>
<td>Duration</td>
<td>Outcomes Improved</td>
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<tr>
<td>Dynamic Gait (obstacle course, gait with head turns, stop and goes)(^7)</td>
<td>N =1</td>
<td>1.5-2 hrs 5x per week</td>
<td>12 weeks</td>
<td>Complex gait (DGI), Spatio-temporal gait parameters (gait velocity)</td>
</tr>
<tr>
<td>Conventional gait training (trunk stabilization, physical conditioning)(^8)</td>
<td>N=1</td>
<td>30 min 5x per week</td>
<td>2 months</td>
<td>Ataxia (SARA), Independence (FAC)</td>
</tr>
<tr>
<td>Auditory cueing (metronome)(^9)</td>
<td>N=1</td>
<td>1 session non-specified</td>
<td>1 day</td>
<td>Spatio-temporal gait parameters (Step time, stance time, double support time, step length)</td>
</tr>
<tr>
<td>Treadmill training (with visual cues)(^2)</td>
<td>N=2</td>
<td>30 min 3x per week</td>
<td>7 weeks</td>
<td>Spatio-temporal gait parameters (Step length, cadence, speed), Complex gait (TUG), Gait quality (RVGA)</td>
</tr>
</tbody>
</table>
Conclusions

There is a mixed level of evidence to support task-specific gait interventions for patients with ataxia.

- High quality evidence:
  - Both over ground gait training with therapist assistance and robotic assisted gait training were found to be equally as effective in improving gait in adults with ataxia.
  - Evident by improved complex gait with reduced ataxia\(^5\)
Conclusions

There is a mixed level of evidence to support task-specific gait interventions for patients with ataxia.

- **Low quality evidence:**
  - Treadmill training (with and without obstacles), body weight support, auditory cueing, and dynamic gait training can improve ataxic gait as evident by improvements in:
    - Spatio-temporal parameters\(^{2,3,6,7,9}\)
    - Complex gait\(^{2,4,5,7}\)
    - Ataxia\(^{1,5,8}\)
    - Independence\(^{3,8}\)
    - Gait quality\(^{2}\)
Limitations

- Small samples
- Vague gait interventions
- Lack of uniform outcome measures
- Lack of control groups
- Long-term follow up
Future Research

- In order to determine the optimal gait intervention for patients with ataxia, future research is needed to:
  - Develop specific ataxic gait outcome measures
  - Implement specific gait interventions for patients with ataxic gait
  - Include higher quality randomized control trials
Clinical Relevance

- Historically, ataxic gait has been treated by weighting the patient’s trunk and lower limbs and through symptom management.\(^3\)
  - Recent research has shown that this is not the most effective rehabilitation for these patients.
- In order to move away from symptom management, clinicians should consider task-specific gait training to meet the individual needs of each patient with ataxia.
Acknowledgements

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Questions?