The Efficacy of Treadmill Training on Balance Dysfunction in Individuals with Chronic Stroke: A Systematic Review

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Background

- Stroke is a leading cause of long-term disability worldwide.
- Historically, treadmill exercise interventions for chronic stroke have been gait-specific.
- Reverse transfer states that repetitive practice of walking tasks improves non-walking functional tasks (i.e. balance).
- Limited research has addressed the efficacy of task-specific locomotor training on balance dysfunction.

Methods

- A systematic literature search of PubMed, EMBASE and CINAHL was performed. Eligible trials were published between 2007 and 2016.
- Methodological quality was assessed using PEDro criteria.

Inclusion Criteria:
- participants with stroke;
- effects of TT were used and compared to controls;
- outcomes included \( \geq 1 \) of the following: postural control/instability or deficits in balance;
- randomized control trial (RCT) methodology;
- e. article in English.

Exclusion Criteria:
- participants < 18 years old;
- Stroke onset within six months;
- statistical analyses not performed for within and/or between group comparisons.

Purpose

To determine the effect of treadmill training (TT) interventions on balance dysfunction in individuals with chronic stroke.

Results

- Eight studies were included in the qualitative analysis.
- Seven RCTs deemed higher quality (PEDro, 2015)
- 275 individuals; mean age: 54.8 yrs; onset: 6.3-70 mos
- Studies differed in TT implementation and use of adjunctive treatments.
- TT was as effective as conventional physical therapy treatment in improving balance measures.

<table>
<thead>
<tr>
<th>Article</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Balance Outcome Measure</th>
<th>Results (p&lt;0.05)</th>
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<tr>
<td>Chen et al, 2014</td>
<td>Circular belt TT, general exercise</td>
<td>TT, general exercise</td>
<td>BBS, LOS</td>
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<tr>
<td>Cho et al, 2015</td>
<td>TT with FES on GM + TA or TA only</td>
<td>TT</td>
<td>BBS</td>
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<tr>
<td>Choi et al, 2015</td>
<td>Cognitive motor dual-task with random auditory cue</td>
<td>TT</td>
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<td>Globas et al, 2012</td>
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<td>Hwang et al, 2015</td>
<td>TT with tilt-sensor FES and WalkAide System</td>
<td>TT with tilt-sensor FES and WalkAide System in “off” position</td>
<td>BBS</td>
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<td>Kang et al, 2016</td>
<td>Nordic TT</td>
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<td>Kim et al, 2011</td>
<td>TT</td>
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<td>Kim et al, 2015</td>
<td>TT eyes-closed on Gait Trainer</td>
<td>TT eyes-closed on Gait Trainer</td>
<td>LOS</td>
<td>★★★</td>
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</tbody>
</table>

Note: BBS = Berg Balance Scale; LOS = measures of Limits of Stability; TTFES = TT with functional electrical stimulation; GM = gluteus maximus; TA = tibialis anterior.

Results Interpretation: @Experimental group p < 0.05, ◆ Control group p< 0.05, ★Intergroup p< 0.05

Conclusions

- Moderate evidence exists in favor of TT interventions in balance and stroke rehabilitation programs.
- With TT, training intensity may be a more critical factor than specificity of training.
- Arm swing amplitude, cognitive demand & motor unit recruitment may be used to increase intensity.
- Critical parameters for “reverse transfer” of TT interventions have not yet been defined.

Clinical Relevance

- Improvements in objective balance measures exist as “off-label” benefits to gait-specific TT.
- Clinicians utilizing TT should incorporate objective measures of balance to assess for skill transference.

Acknowledgements / References

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