Neural Fitness & Aging

Dual-Task Training Program For Older Adults with Fall History: Blending Gait, Visuomotor And Cognitive Training

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Mobility/Falls & Neural Fitness

Aging Effects

Balance Skills

Walking-Mobility Skills

Visuomotor & Gaze Stability

Cognitive Skills

Multi-tasking Skills
Evidence growing DT training using “digital media” playing “cognitive” computer games has beneficial effects for older adults

- Executive function
- Processing speed
- Gait function/stability
- Dual-task function
PURPOSE: Exploratory RCT To determine the feasibility & benefits of two game-based dual-task training program for older adults delivered in a community fitness centre

One group Received Dual-Task Treadmill Walking (Mobility skills)

Second group Received Dual-Task recumbent cycling (aerobic)

Both groups performed the same cognitive activities delivered through interactive “cognitive” computer games
Ten week program 2times per week
### Participants

**22 Older Adults (11 per group)**

**Inclusion criteria:**
- Independent community living with fall history and concerns with balance; no neurological disorder; MMSE > 25

<table>
<thead>
<tr>
<th></th>
<th>DT-Treadmill.</th>
<th>DT-Cycle</th>
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<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>75.5±3.1</td>
<td>76.1±3.9</td>
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<tr>
<td><strong>Gender ratio</strong></td>
<td>6:5</td>
<td>5:6</td>
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<tr>
<td><strong>Mini mental status examination</strong></td>
<td>28.7±1.0</td>
<td>29±0.44</td>
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<tr>
<td><strong>Gait speed (m/s)</strong></td>
<td>1.13±0.1</td>
<td>1.03±0.6</td>
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<tr>
<td><strong>6MWT (215.16 m./lap)</strong></td>
<td>484.2±41.9</td>
<td>512.5±33</td>
</tr>
<tr>
<td><strong>five times sit to stand (second)</strong></td>
<td>10.18±2.5</td>
<td>10±0.8</td>
</tr>
<tr>
<td><strong>Number of falls in the past year</strong></td>
<td>1.2±.4</td>
<td>1.3±0.6</td>
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Treatment
Dual-Task Treadmill Workstation

Miniature “motion mouse” on head band/cap is game controller.

Simple method for responsive hands-free interaction with any commercial “brain-fitness” computer game.

Wide range of cognitive game activities can easily be managed concurrently while performing dynamic balance activities and walking.
Visuomotor Tracking Task & Outcome measures

Outcome Measures
- Total/Average Residual Error
- Amplitude Consistency
Cognitive Game Tasks and Outcome Measures

Sphere large dots is game “Target. object
Sphere small dots is “Distractor. object

Goal = move paddle catch Target and avoid Distractor

Duration of each game event = 2 seconds

Automated Outcomes
- Success rate
- Response time
- Execution time
- Absolute error
- Response variation
Outcome Measures
Root mean square (RMS) and Total Path Length of COP displacement
DT-Gait Performance Analysis

Outcome Measures

• Average and COV step length
• Average and COV of stride time
Qualitative Findings

3 drop-outs: 2 from DT-Treadmill group
   - 2 for unrelated injuries
   - one found DT treadmill program too difficult
Otherwise compliance was 100%

Participant views on program (Interviews)

- None of the participants played computer games
- Most found DT program to be quite challenging and for some it took time for them to learn how to play the games while exercising
- They found some games interesting and some they disliked. Most reported they were engaging and fun and required considerable focus/attention
- Most commented (liked) the variety of games
- Most found DT treadmill program quite difficult at first but it got easier
- A number of participants in the DT recumbent cycle group would have preferred the DT treadmill i.e. perceived a better challenge to balance/gait
- Some found head mouse difficult to get use to but with practice it did become natural
- The motion mouse did drift and this was a problem and quite annoying
- Most were willing to continue the program
Effects of Intervention on Standing Balance Performance

Within Group - Significant improvement both groups

Between Group - Greater improvement seen in DT-Tread. Vs Dt-Cycle

Group means & SEM for RMS COP displacement
Effects of Intervention on Walking Performance

Within Group

- Significant improvements DT—Treadmill group only
- COV-step length & step time decreased
- Average step length increased

Visuomotor
Cognitive game

COV - Step Length

<table>
<thead>
<tr>
<th></th>
<th>Walk Only</th>
<th>DT Visuomotor</th>
<th>DT Cognitive Game</th>
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</thead>
<tbody>
<tr>
<td>Treadmill</td>
<td><img src="image1.png" alt="Graph" /></td>
<td><img src="image2.png" alt="Graph" /></td>
<td><img src="image3.png" alt="Graph" /></td>
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<tr>
<td>Cycle</td>
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<td><img src="image5.png" alt="Graph" /></td>
<td><img src="image6.png" alt="Graph" /></td>
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Pre | Post
Effects of Intervention on Visuomotor/ Gaze Performance

Within Group - Significant improvement both groups

Between Group – No group difference

DT Testing

Visuomotor Performance

Treadmill | Cycle

Pre | Post
Effects of Intervention On Visuospatial Cognitive Performance

Within Group - Significant improvement both groups

Between Group – No group difference

DT Testing
Effects of Intervention on Executive Function Test Scores (sitting)

Verbal Fluency & Visual Search Test
No Within or Between Group effects improvement both groups

Trail Making Test part A & B
Within Group - Significant improvement both groups
Between Group - Greater improvement seen in DT Treadmill group

![Bar chart showing improvements in TMT-A and TMT-B for Treadmill and Cycle groups.](image)
Similar Study just completed on 15 Parkinson’s Patients

Does Use of a Dual-task cognitive game-based treadmill platform improve gait in Parkinson Disease? A feasibility study
Bhuvan Mahana, Douglas Hobson, Ji Hyun Ko, Tony Szturm

**Background:** Both gait impairments and the decline in executive cognitive functions have been proven to increase fall risk and mobility limitations in individuals with Parkinson’s disease (PD). As such, there is a need to develop further approaches that combine gait with executive cognitive activities.

**Purpose and Objectives:** To provide evidence of the feasibility of conducting a full-scale randomized controlled trial (RCT) using the GTP for dual task walking training in PD. The

**Participants:** Fifteen participants diagnosed with PD, stage 2-3 on Hoehn and Yahr scale.

**Intervention:** A 10 week, (twice per week) DT treadmill gait training program which included various visuomotor and cognitive game task

**Results:** - Conclusion: Although some difficulties with the technology were reported, the findings demonstrate feasible trial procedures and acceptable DT task-oriented training with a high compliance rate and positive outcomes. These findings and the theoretical evidence direct the next phase of a full-scale randomized controlled trial (RCT).
CONCLUSION

Although some difficulties with the technology were reported, the findings demonstrate feasible trial procedures and acceptable task-oriented training with a high compliance rate and positive outcomes.

These findings and the theoretical evidence direct the next phase of a full-scale randomized controlled trial (RCT).
BRAIN HEALTH
Keep your neurons fit & have fun doing it

Thank You