Use of Intelligently Controlled Assistive Rehabilitation Elliptical Trainer to Improve Walking and Fitness during Acute Stroke Rehabilitation

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Introduction

Regaining walking ability is a major goal for many individuals following a stroke. While devices exist to enable mass repetition of gait-like movements thought to be important for promoting neuroplastic changes, patients lack access due to the expense (e.g., robotic gait trainers) or need for multiple clinicians (e.g., partial body weight support treadmill training). ICARE, an Intelligently Controlled Assistive Rehabilitation Elliptical trainer, is an affordable training device developed to address these barriers.

Methods

Instrumentation
• ICARE trainer including an elliptical with custom modifications for accessibility, safety, & movement assistance (Figure 1)

Procedures
• Participants trained on the ICARE 3-5 times/week as an adjunct to physical therapy (mean total sessions=10; range=3-25)
• Initial velocity (VEL), stride length (SL), and body weight support (BWS) settings were individualized to each participant
• Total duration of exercise per session (DUR) and subsequent setting adjustments were determined based on participant’s fatigue and cardiovascular response

Data Analysis
• Each participant’s heart rate (HR) and rating of perceived exertion (RPE) recorded at beginning (first two sessions averaged) and end (last two sessions averaged) were compared
• Self-selected overground walking velocity and ICARE training parameters pre and post ICARE training were assessed

Statistical Analysis
• Paired t-tests evaluated significant changes in training parameters (i.e., VEL, SL, total strides/session, DUR, and BWS)

Results

Figure 1. Participant using ICARE Trainer

<table>
<thead>
<tr>
<th>Training Parameters, Mean</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICARE Velocity (RPM)</td>
<td>26</td>
<td>21</td>
</tr>
<tr>
<td>ICARE Stride Length (in)</td>
<td>426</td>
<td>776</td>
</tr>
<tr>
<td>ICARE Strides/Session</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>ICARE Duration (min)</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>ICARE BWS (%BW)*</td>
<td>19</td>
<td>37</td>
</tr>
<tr>
<td>Walking Velocity (m/min)*</td>
<td>21</td>
<td>19</td>
</tr>
</tbody>
</table>

* = Significantly Different

Conclusions

ICARE enabled mass practice of a simulated gait activity, as evidenced by the large number of strides/session. The augmentation of traditional therapy with ICARE was tolerated well. Important gains were noted in endurance and speed (both overground walking and ICARE training).

Clinical Relevance

This study provides clinicians with essential data for prescribing innovative and affordable exercise interventions in conjunction with using the ICARE trainer and walking.

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