The Impact of a Motivational Task On Motor Learning During Reactive Balance in an Individual With Cerebellar Deficits: A Case Report

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Background & Purpose

- The cerebellum is critical for the execution of appropriate extremity movements and regulation of balance.1
- Due to the degenerative effect on motor learning in cerebellar disease, the benefits of specific physical therapy interventions remain uncertain.1,2
- Although maximally challenging and intensive balance training has shown to be effective, evidence based interventions are still limited.1,2
- Other populations with similar balance deficits have shown positive outcomes utilizing reactive balance and task oriented training with altered sensory input.3,4
- The purpose of this case report was to utilize a motivational task, emphasizing somatosensory awareness and challenging reactive balance training, to improve functional outcomes.

Case Description

- 35-year-old male, six years status post TBI and medulla blastoma resection causing cerebellar ataxia.
- Major symptoms include decreased balance and self-awareness leading to impaired motor planning, decreased coordination, and general deconditioning.
- Ambulates independently without a device but uses a wide BOS and marked deviations.
- After six months without therapy, the patient reported a decline in endurance and balance.

Interventions

- The patient received a one-hour session of therapy each week, for 8 weeks.
- Initial treatments focused on coordination and motor planning (tandem walking, toe-taps, alternating opposite hand to knee coordination)
- Mid-way through therapy, interventions transitioned to an emphasis on somatosensory awareness within a reactive balance program to simulate carrying his 7-month old nephew comfortably and safely. See Image A.
- An 18lb doll was created to simulate patient’s nephew and was used to progress interventions.
- Difficulty of interventions were progressed utilizing the Rate of Perceived Stability (RPS) Scale
- Interventions were progressed from standing to walking, and from single to dual tasking
- Examples of intervention progression can be seen in Image B.

Outcomes

Pre/post testing was performed at initial evaluation and after eight weeks of therapy. The following outcomes measures were used: Timed Up and Go (TUG), Four Square Step Test (FSST), Functional Gait Assessment (FGA). Pre/post testing for the Scale for the Assessment and Rating of Ataxia (SARA) was performed at five weeks and eight weeks. Refer to Chart 1.

Chart 1

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre</th>
<th>Post</th>
<th>Difference</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUG (seconds)</td>
<td>12.37</td>
<td>10.44</td>
<td>1.93</td>
<td>IMPROVED 16%</td>
</tr>
<tr>
<td>FSST (seconds)</td>
<td>15.30</td>
<td>14.58</td>
<td>0.72</td>
<td>IMPROVED 4.7%</td>
</tr>
<tr>
<td>FGA (out of 30)</td>
<td>18</td>
<td>24</td>
<td>6</td>
<td>IMPROVED 20%</td>
</tr>
<tr>
<td>SARA (out of 40)</td>
<td>12</td>
<td>11</td>
<td>1</td>
<td>IMPROVED 2.5%</td>
</tr>
</tbody>
</table>

Observational Analysis After Intervention Focus Switched to a Motivational Task:

- Increased self-awareness and ability to initiate appropriate stepping responses before a loss of balance
- Improved quality of gait including speed consistency and reduced lateral deviations and base of support
- Patient reported increased confidence in balance and stability

Discussion

- An intervention plan utilizing a motivational component in conjunction with a somatosensory based reactive balance training program may be beneficial in people with cerebellar deficits.5
- The patient’s improvements on the TUG, FGA, and self-reported balance are consistent with improvements found in research focused on balance control.
- Limitations in this case report include 1) a single subject design, 2) frequency of treatment, and 3) difficulty in isolating what aspect had the greatest impact: task specific and motivating balance, or integrative social, cognitive, and affective components into treatments.
- The motivational goal of carrying the child appeared to be critical in improving his outcomes, reinforcing the importance of integrating social, cognitive, and affective components into treatments.
- Future studies should continue to investigate the importance of focusing on a motivational task to provide comprehensive treatments with this population.

References