The Effects of Intensive Locomotor Training on Two Pediatric Patients with Spinal Cord Injury without a History of Ambulation

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BACKGROUND AND OBJECTIVES

• Approximately 3-4% of spinal cord injuries occur in patients less than 15 years old, and therefore, is considered a childhood disability.
• Rehabilitation after a spinal cord injury (SCI) has recently evolved from utilizing compensatory strategies to recovery based therapy, which is contingent upon experience-dependent neuroplasticity.
• Locomotor training is a popular activity-based therapy reliant on neuroplasticity and past experiences.
• Developmentally, the skill of ambulation emerges between 10-12 months.
• Children who are injured prior to developing independent ambulation do not have past experiences to refer to.

The purpose of this case study was:
• To determine whether locomotor training (LT) is effective in two patients who both sustained a spinal cord injury prior to reaching the developmental milestone of ambulation.

METHODS

Patient Selection:

<table>
<thead>
<tr>
<th>Current Age</th>
<th>Age of Injury</th>
<th>Mechanism of Injury</th>
<th>Level of Injury</th>
<th>Primary Means of Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient A</td>
<td>18 months</td>
<td>Cardiac surgery</td>
<td>Lumbar¹</td>
<td>Scooting, Dependent</td>
</tr>
<tr>
<td>Patient B</td>
<td>21 months</td>
<td>Transverse myelitis</td>
<td>CS-TB²</td>
<td>Wheelchair, Commando crawling</td>
</tr>
</tbody>
</table>

¹Patient A had a MAS of 4 in bilateral quad, and 3/5 strength in bilateral hip flexors, 1/5 in bilateral anterior tibialis, 0/5 in all other lower extremity muscles.
²Patient B had a MAS of 0 in bilateral lower extremities, and 0/5 throughout lower extremities.

Intervention:
• Both patients participated in a 5 day/week program for four weeks, in which they spent up to 60 minutes a day in a body weight support system on the treadmill. This was immediately followed by 30 minutes of traditional physical therapy.
• During the treadmill training portion, three therapists were assisting the patient to facilitate normal gait kinematics (two at the lower extremities and one at the pelvis) and body weight support was adjusted to maintain proper trunk and pelvic kinematics in standing.
• The traditional therapy sessions focused on gait and balance training.
• Parents were educated on a home exercise program, which emphasized weight bearing activities.

RESULTS

Patient A:
• Decreased quadriiceps spasticity MAS of 4 to 3
• Increased knee flexion and dorsiflexion range of motion
• Increased hip flexor and dorsiflexor strength by 1 grade
• Cruised with supervision
• Pulled-to-stand with supervision
• Ambulated 25-feet intervals with a posterior rolling walker, bilateral ankle foot orthoses (AFOs), and minimal assistance
• Decreased body weight support assistance from 40% to 10%

Patient B:
• Improved trace muscle contraction in bilateral hip flexors
• Improved sitting balance from 0 to 10 seconds without upper extremity support
• Initiated weight shifting in supported standing, high kneeling and quadruped positions
• Ambulated 15-feet intervals with a posterior rolling walker, bilateral AFOs with knee immobilizers, and moderate assistance
• Decreased body weight support assistance from 40% to 20%

DISCUSSION

These case studies demonstrate the positive benefits of body weight support treadmill training in pediatric patients who sustained spinal cord injury prior to developing the ambulation milestone. This intervention leads to:

- Decrease in spasticity
- Increase in lower extremity strength
- Increase in core strength
- Improvement in sitting balance
- Improvement in standing balance

The majority of studies reporting the effects of treadmill training in pediatrics has been performed in diagnoses other than spinal cord injury. There have been numerous studies on the benefits of locomotor training in adults with spinal cord injury. Therefore, further research needs to be completed on pediatric patients with spinal cord injury, as well as patients with spinal cord injury who were injured prior to developing ambulation.

CONCLUSION

These case studies exemplify the importance of capitalizing on neuroplasticity at a young age. This locomotor training program improved impairments in both patients, which led to an increase in overall functional mobility.