Novel Sensory Intervention to Promote Late Motor Recovery in an Individual with Incomplete Spinal Cord Injury: A Case Report

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BACKGROUND
Incomplete cervical spinal cord injury (SCI) is now the most common category of new traumatic SCI in the United States1. Most of these individuals are sensory incomplete2. If interventions capitalizing on the sensory preservation can be used to facilitate motor recovery, the population of individuals with SCI will benefit.

PURPOSE
Describe the use of progressive stereognosis activities followed by motor level electrical stimulation that promoted meaningful motor recovery in one patient with incomplete SCI.

CASE DESCRIPTION
19 year old female with incomplete Brown Sequard syndrome ASIA D SCI since age 12 with L sensory and R motor impairment. Presenting function: ambulatory and willing to utilize her R UE. There was visible and apparent protective posture of shoulder IR and abduction and forearm pronation. This arm was used for writing with a gross grip but otherwise intentionally neglected. Tactile sensation was intact in the R hand.

INTERVENTION
Participant attended 6 one-hour appointments over 11 weeks at the University of Puget Sound Onsite Student Physical Therapy Clinic. Each session included progressive stereognosis training followed by electrical stimulation to wrist extensor and finger extrinsic muscles. Table 1 details specific stereognosis activities, TENS parameters and motor ability noted in each session.

OUTCOME
At discharge, participant was more comfortable and willing to utilize her R UE. There was visible definition in her R triceps and forearm musculature, as well as a noticeable decrease in the erythema in her R hand. She was able to perform 11 repetitions from full R elbow flexion to extension, holding a ¼ pound weight, with her shoulder flexed to 90 degrees. She achieved antigravity R wrist extension and was able to utilize R wrist and finger extensors during therapeutic exercises and sensory-motor activities, and exhibited progressively refined stereognosis ability.

DISCUSSION
Studies have shown that improved function is possible in chronic SCI.2,4 The participant in this study made significant gains in strength, motor activation and stereognosis ability in a very short time. The speed at which these gains occurred is likely a result of reversing learned non-use and re-activating volitional pathways that had been latent.

CLINICAL RELEVANCE
This case adds to the literature supporting the use of afferent input to facilitate motor recovery after SCI.

Table 1. Sensory re-training intervention, parameters and motor ability for each visit over course of 11 weeks

<table>
<thead>
<tr>
<th>Visit</th>
<th>Sensory Retraining</th>
<th>TENS</th>
<th>Motor Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/20/15</td>
<td>Eyes Closed: Large wooden letter identification Wooden ring placement</td>
<td>75 MHz -225 microseconds</td>
<td>Palpates wooden letters and spells out 3-letter words</td>
</tr>
<tr>
<td>5/21/15</td>
<td>Eyes Closed: Large wooden letter identification Coin palpation</td>
<td>-</td>
<td>Palpates and identifies smaller letters of a different texture than previous sessions</td>
</tr>
<tr>
<td>5/4/15</td>
<td>Eyes Closed: Plastic letter identification</td>
<td>-</td>
<td>Palpates and calculates amount of currency placed in front of her; correctly calculates 8 different combinations of 3, 4, and 5 coins</td>
</tr>
<tr>
<td>5/9/15</td>
<td>Eyes Closed: Dominoes palpation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5/17/15</td>
<td>Eyes Closed: Scrabble tile palpation and ID (single letter and multi-letter)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5/23/15</td>
<td>Eyes Closed: Scrabble tile palpation and ID (single letter)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 1. Stereognosis activity

Figure 2. Voluntary wrist extension at discharge