Reviewer ID: Christie Chan, Matthew Quéré

Type of Outcome Measure: Surface Electromyography (sEMG)  |  Total articles: 4

<table>
<thead>
<tr>
<th>Author ID Year</th>
<th>Study Design</th>
<th>Setting</th>
<th>Population (sample size, age) and Group</th>
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</thead>
</table>
| Calancie et al. 2001 | Longitudinal study | Jackson Memorial Hospital at the University of Miami School of Medicine | N=45  
No indication of age.  
Acute SCI  
Level of injury:  
34 cervical  
11 T2-L3. |
| Lim et al. 2005 | Cross-sectional retrospective study of a neurophysiological method of voluntary motor control characterization. | VA Medical Centers in Houston and Dallas Texas, USA. | 67 subjects with incomplete spinal cord injury (iSCI)  
63 males, 4 females  
mean age: 49.5±15.2  
AIS C=32  
AIS D: 35  
15 AB participants  
Level of injury:  
40 cervical  
18 between T1-T9  
9 below T10 |
| Lim & Sherwood 2005 | Retrospective analysis | 2 Texas Department of Veterans Affairs (VA) medical centers | 69 incomplete SCI subjects (65 males, 4 females)  
mean age: 48.1±4.6 yrs  
54.8 ± 3.6 months postinjury  
15 AB participants  
(11 males, 4 females)  
mean age: 36±10 yrs  
Injury classification:  
AIS C: 34  
AIS D: 35 |
| Lim et al. 2004 | Retrospective analysis | Not specified | 9 SCI subjects with injury levels ranging from C6 – T8 (time post injury: 11±5 months)  
10 neurologically healthy subjects (9 males, 1 female) mean age: 37.9 ± 13.9 years  
10 AB participants served as control to establish "prototype" responses  
9 SCI subjects were enrolled in independent studies to evaluate the effect of supported treadmill ambulation training (STAT). This subject group was expected to improve their gait as a result of STAT and, in fact, all showed increases in over-ground gait speed. For the purpose of this report, the STAT group served to test the sensitivity of VRI calculations to motor control changes brought by intervention. |

1. RELIABILITY

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Internal Consistency</th>
<th>Test-retest, Inter-rater, Intra-rater</th>
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Correlation analysis results showed a moderate to strong correlation for 3 repeated measures:
\[ r = 0.83 \text{ to } 0.98 \text{ for magnitude (P}<.05) \]
\[ r = 0.77 \text{ to } 0.88 \text{ for similarity index (SI) (P}<.05) \]

The magnitude \((r=0.93\pm0.04)\) showed stronger correlation than SI \((r=0.83\pm0.04)\) overall.

Flexion movements \((r=0.95\pm0.03\) for magnitude and \(r=0.86\pm0.03\) SI) showed significantly higher correlation than extension movements \((P<.05)\). 3 repetitions for each of the 10 motor tasks were analyzed for repeatability with the use of ICCs.

**Short term reliability:**
The reliability of the 2 components of the VRI (voluntary response index), magnitude and SI (similarity index) were good \((ICC=0.93\pm0.05\) for magnitude and ICC=0.83±0.04 for SI) for the 69 SCI subjects. ICCs of magnitude were slightly larger than those of SI \((P<.01)\)

The magnitude of 15 AB subjects showed good reliability \((ICC=0.90\pm0.04)\).

**Intermediate term reliability:**
Data recorded 1 week apart from 6 subjects for 10 motor tasks showed fairly strong correlation for magnitude \((r=0.91, P<.01)\) and SI \((r=0.87, P<.01)\).

### 2. VALIDITY

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Validity</th>
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<tbody>
<tr>
<td>Calancie et al. 2001</td>
<td>EMG was used to record isolated, maximal contractions of 12 muscles groups and voluntary recruitment efforts were scored from 0 to 5. Eight of the 12 muscle groups were assessed for strength with Manual Muscle Testing (MMT). EMG was performed in the acute phase (~ 1 week post injury) and MMT was performed in the sub-acute phase (2mo±1wk). Muscles examined with both methods were: biceps, triceps, extensor carpi radialis (ECR), abductor digiti minimi (ADM), psoas major, quadriceps, tibialis anterior (TA) and soleus. Nonparametric Spearman Rank correlations were used to compare muscle strength scores from EMG and MMT. When muscle scores of zero were found for both EMG and MMT but were included in the analysis, all correlations were significant ((P&lt;.01)) at both time points. If those with double zero scores were excluded from the data analysis, all were significant except for the soleus muscle at the acute time point ((r=0.28, P=0.19)). Correlation coefficients are as follows when zero scores were not included (acute, sub-acute): biceps ((0.56, 0.40)), triceps ((0.77, 0.70)), ECR ((0.64, 0.64)), ADM ((0.49, 0.67)), psoas ((0.47, 0.77)), quadriceps ((0.54, 0.61)), TA ((0.57, 0.78)) and soleus ((0.28, 0.59)).</td>
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<tr>
<td>Lim et al. 2005</td>
<td>The AIS unilateral motor scores were correlated to the different similarity indexes (SIs) representing individual motor tasks or combinations of tasks, for example, proximal movements together or flexion movements together. Correlation coefficients ranged from 0.22 to a high of 0.80 ((P&lt;.01)) which was observed for the four unilateral motor tasks taken together. Hip–knee flexion, dorsi- flexion and plantar flexion showed the strongest correlation coefficients, 0.80 ((P&lt;0.01)) with unilateral motor scores. All correlation coefficients between motor score and combined SI values that included the dorsi- flexion task were over 0.75 ((P&lt;.01)) An SI value of 0.85 was found to separate AIS-C and AIS-D groups with a sensitivity of 0.89 and a specificity of 0.81.</td>
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<td>Lim &amp; Sherwood 2005</td>
<td>No group difference existed for AIS-C ((r=0.80\pm0.08)) and AIS-D ((r=0.87\pm0.12)) in the correlation analysis of SI.</td>
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<td>Lim et al. 2004</td>
<td>The VRI changes over the time in which STAT was administered were variable across SCI subjects. In general, SIs (similarity index) moved toward 1.0 following completion of training. Subject 1 had starting SI values bilaterally near 1.0 and subjects 3 and 4 were nearly 1.0 on their right. Five subjects ((2r, 4r, 6r, 7r, 8l)) showed a unilateral increase toward the prototype, range 0.08 to 0.16, and mean change of</td>
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0.11±0.04. Two subjects (3 and 7) showed unilaterally and one subject (9) bilaterally decreased SIs, or movement away from the prototype.

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<thead>
<tr>
<th>3. RESPONSIVENESS</th>
<th>no data available</th>
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<tr>
<td>4. FLOOR/CEILING EFFECT</td>
<td>no data available</td>
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<tr>
<td>5. INTERPRETABILITY</td>
<td>no data available</td>
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