Within- and Between-Day Reliability of Corticomotor Assessment Techniques in the Upper Extremity

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Introduction

• Transcranial magnetic stimulation (TMS) is commonly used to quantify corticomotor excitability for both healthy and pathologic populations.

• To understand of normal central neuromuscular function may help a healthcare provider identify origin of the musculoskeletal dysfunction and make informed decisions.

• While reliability of TMS-related measures has been studied extensively in lower extremity and intrinsic hand muscles, their reliability has not been fully examined in muscles in the proximal upper limb.

Methods

• 21 healthy individuals (M: 16, F: 5)

• Test-retest reliability study

  • IV: Time (Day1-A, Day1-B, Day2, Day3, Day4)

  • DV:

    ▪ Active Motor Threshold (AMT; %)
    ▪ Peak-to-peak Motor Evoked Potential amplitude @120% AMT (MEP; mV)

  • Statistical analysis

    ▪ Intraclass Correlation Coefficient (ICC;1)
    ▪ Standard Error of Measurement (SEM)
    ▪ 95% Minimal Detectable Change (MDC95)

Purpose

1. To determine the within-and-between-day reliability of common TMS measures in the proximal upper extremity, and

2. To estimate minimal true differences for TMS measurements applicable to clinical settings.

Results

AMT

<table>
<thead>
<tr>
<th>Muscle/Limb</th>
<th>Day1-A vs. D1-B</th>
<th>Day1-B vs. Day2</th>
<th>Day2 vs. Day3</th>
<th>Day3 vs. Day4</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMT Upper Trapezius (Dominant)</td>
<td>0.68 (0.45, 0.84)</td>
<td>0.66 (0.43, 0.83)</td>
<td>0.70 (0.47, 0.85)</td>
<td>0.71 (0.48, 0.86)</td>
</tr>
<tr>
<td>AMT Upper Trapezius (Non-Dominant)</td>
<td>0.55 (0.25, 0.78)</td>
<td>0.53 (0.22, 0.75)</td>
<td>0.54 (0.23, 0.76)</td>
<td>0.55 (0.25, 0.77)</td>
</tr>
</tbody>
</table>

MEP

<table>
<thead>
<tr>
<th>Muscle/Limb</th>
<th>D1 vs. D2</th>
<th>D1 vs. D3</th>
<th>D1 vs. D4</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMT Flexor Carpi Radialis (Dominant)</td>
<td>0.86 (0.69, 0.94)</td>
<td>0.88 (0.74, 0.95)</td>
<td>0.85 (0.67, 0.94)</td>
</tr>
<tr>
<td>AMT Flexor Carpi Radialis (Non-Dominant)</td>
<td>0.77 (0.52, 0.90)</td>
<td>0.71 (0.41, 0.88)</td>
<td>0.67 (0.32, 0.86)</td>
</tr>
</tbody>
</table>

MDC95 for AMT (%)

<table>
<thead>
<tr>
<th>Muscle/Limb</th>
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<th>Day1-B vs. Day2</th>
<th>Day2 vs. Day3</th>
<th>Day3 vs. Day4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Trapezius</td>
<td>3.89</td>
<td>7.07</td>
<td>11.03</td>
<td>10.51</td>
</tr>
<tr>
<td>Middle Deltoid</td>
<td>0.47</td>
<td>5.15</td>
<td>2.13</td>
<td>5.29</td>
</tr>
<tr>
<td>Flexor Carpi Radialis</td>
<td>2.60</td>
<td>5.45</td>
<td>6.75</td>
<td>7.95</td>
</tr>
</tbody>
</table>

Discussion

AMT

• Reliability

  ▪ FCR ≥ MD > UT

  ▪ Difference in cortical representations and corticospinal projections

  ▪ Higher motor threshold for UT should require higher TMS intensity in testing UT (45-55%) > MD (35-45%) > FCR (30-40%)

MEP

• Poor reliability across the sessions under current testing protocol

• Testing techniques still underdeveloped

  ▪ Alternative (subject’s position, pre-activation) methods?

  ▪ Increased number of stimuli?

  ▪ How to normalize the data for comparison?

Recommendation for use

AMT was generally reliable for MD and FCR in clinical research

Conclusions

• AMTs produced acceptable reliability to examine corticomotor excitability for MD and FCR in healthy individuals.

• UT was altogether less reliable for both AMT and MEP.

• MEPs demonstrated poor reliability with the techniques described in this study.

References


