Reliability and agreement of Neck FCE tests in patients with chronic multifactorial neck pain

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Introduction / Conflict of interest

Professor Rehabilitation Medicine RuG UMCG

- Pain
- Work

Physical Therapist & Movement Scientist

- Pain Alliance in the Netherlands (PA!N)
- Fit for Work NL
- EFIC - Societal Impact of Pain
- WorkWell FCE trainer
Background:

- Reliability and safety of FCE in patients with chronic neck pain understudied
- Trippolini et al, WAD, JOR, 2013

Objective:

- To analyze **test-retest reliability** and **agreement**, and to explore **safety** of Neck Functional Capacity Evaluation tests (Neck-FCE) in patients with chronic multifactorial neck pain.
Methods

- Test-retest design; 2 FCE sessions - 2 week interval.
- Setting: university outpatient rehabilitation center in the Netherlands.
- Participants: chronic multifactorial neck pain >3 months, enrolled in outpatient rehabilitation, Dutch language, signed informed consent
- Assessors: PT, blinded.
Tests SF Neck-FCE protocol

1. Lifting waist to overhead (kg)
2. Two-handed carrying (kg)
3. Overhead working (s)
4. Repetitive bending and overhead reaching (s)
5. Repetitive side reaching left (s)
6. Repetitive side reaching right (s)

Test endpoint criteria

1. Heart rate maximum allowed HR
2. Biomechanical control of self and load
3. Subject patient decided to stop
4. Criterion normal end of the test
Other variables and analyses

Pain Response Questionnaire (PRQ) - 24 hours after FCE
- normal: muscular pain and/or a temporary increase of already existing (neck-) pain

Numeric Rating Scale (NRS; 0-10) - Pain intensity
Neck Disability Index (NDI; 0-50) - Neck pain-related disability
Pain Disability Index (PDI; 0-70) – Pain-related disability

Analyses
Intraclass Correlation Coefficients (ICCs) and limits of agreement (LoA)
- Excellent  ICC≥0.90, and lower border (LB) of 95%CI≥0.75
- Good  ICC≥0.75 and LB 95%CI≥0.50
- Moderate  ICC≥0.50 and LB 95%CI≥0.25
- Poor  ICC≤0.50 and LB 95%CI≤0.25
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>Mean ± SD or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>18</td>
<td>33.7±10.9</td>
</tr>
<tr>
<td>Disability (PDI, 0–70)</td>
<td>18</td>
<td>39.1±12.5</td>
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<tr>
<td>Disability t0 (NDI, 0–50)</td>
<td>16</td>
<td>25.1±7.1</td>
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<tr>
<td>Disability t1 (NDI, 0–50)</td>
<td>10</td>
<td>24.9±5.2</td>
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<tr>
<td>Pain t0 (NRS, 0–10)</td>
<td>18</td>
<td>5.2±2.3</td>
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<tr>
<td>Pain t1 (NRS, 0–10)</td>
<td>18</td>
<td>6.0±2.3</td>
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<tr>
<td>Pain duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3–6mo</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>0.5–1y</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>1–5y</td>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>&gt;5y</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Tests</td>
<td>n</td>
<td>Mean t0</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----</td>
<td>---------</td>
</tr>
<tr>
<td>Overhead lift (kg)</td>
<td>18</td>
<td>10.9</td>
</tr>
<tr>
<td>Two-handed carry (kg)</td>
<td>18</td>
<td>23.3</td>
</tr>
<tr>
<td>Static overhead work (s)</td>
<td>17</td>
<td>106.2</td>
</tr>
<tr>
<td>Repetitive bending and overhead reaching (s)</td>
<td>11</td>
<td>50.3</td>
</tr>
<tr>
<td>Repetitive side reaching Right (s)</td>
<td>11</td>
<td>82.0</td>
</tr>
<tr>
<td>Repetitive side reaching Left (s)</td>
<td>11</td>
<td>94.1</td>
</tr>
</tbody>
</table>

Table 2  Test results of 2 Neck-FCE sessions, and LoA and intraclass correlation between the test results

<table>
<thead>
<tr>
<th>Tests</th>
<th>n</th>
<th>Mean t0</th>
<th>SD t0</th>
<th>Mean t1</th>
<th>SD t1</th>
<th>Mean Difference</th>
<th>SD of Mean Difference</th>
<th>95% CI of ICC</th>
<th>Interpretation ICC</th>
<th>Ratio of LoA (%)</th>
<th>95% CI of ICC</th>
<th>Interpretation of ICC</th>
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</thead>
<tbody>
<tr>
<td>Overhead lift (kg)</td>
<td>18</td>
<td>10.9</td>
<td>8.8</td>
<td>10.7</td>
<td>9.8</td>
<td>.28</td>
<td>2.8</td>
<td>.89 - .98</td>
<td>Excellent</td>
<td>50.1</td>
<td>.96</td>
<td>.89 to .98</td>
</tr>
<tr>
<td>Two-handed carry (kg)</td>
<td>18</td>
<td>23.3</td>
<td>18.7</td>
<td>22.4</td>
<td>18.8</td>
<td>.89</td>
<td>5.9</td>
<td>.88 - .98</td>
<td>Excellent</td>
<td>50.1</td>
<td>.95</td>
<td>.88 to .98</td>
</tr>
<tr>
<td>Static overhead work (s)</td>
<td>17</td>
<td>106.2</td>
<td>79.2</td>
<td>103.8</td>
<td>70.9</td>
<td>2.5</td>
<td>26.9</td>
<td>.84 - .91</td>
<td>Excellent</td>
<td>50.3</td>
<td>.94</td>
<td>.84 to .98</td>
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<tr>
<td>Repetitive bending and overhead reaching (s)</td>
<td>11</td>
<td>50.3</td>
<td>2.8</td>
<td>52.6</td>
<td>3.7</td>
<td>-2.4</td>
<td>8.4</td>
<td>-.24 - .79</td>
<td>Poor</td>
<td>32.0</td>
<td>.71</td>
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<tr>
<td>Repetitive side reaching right (s)</td>
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<td>82.0</td>
<td>15.8</td>
<td>88.5</td>
<td>27.1</td>
<td>-6.5</td>
<td>24.6</td>
<td>-.23 - .79</td>
<td>Poor</td>
<td>56.5</td>
<td>.39</td>
<td>-.23 to .79</td>
</tr>
<tr>
<td>Repetitive side reaching left (s)</td>
<td>11</td>
<td>94.1</td>
<td>22.6</td>
<td>88.6</td>
<td>25.4</td>
<td>5.5</td>
<td>21.0</td>
<td>.09 - .88</td>
<td>Poor</td>
<td>45.0</td>
<td>.63</td>
<td>.09 to .88</td>
</tr>
</tbody>
</table>

* Ratio of LoA (%): the ratio between the LoA and the mean score ([1.96 × SD of mean difference]/mean session 1 and 2 × 100%).
† One participant stopped performing after second test.
‡ Six patients did not completely perform the FCE.
Results

Pain response - 24 hours post FCE (pretest mean 5.2 (SD2.3))

- Neck mean 6.7 (SD 2.6)
- Shoulder mean 6.3 (SD 3.0).
- No injuries or serious adverse events

Additional analyses:

- Drop-outs versus completers: differences ns.
- Sensitivity: reps / time in early terminators: difference ns.
Discussion

ICC's similar - CLBP, early OA hip and/or knee, one-handed workers, healthy workers.

Comparison with Trippolini et al (WAD only):
- Similar ICC's - broader sample of diagnoses, different setting and jurisdiction
- Generalizability and robustness
- Exception: repetitive side reaching

Limits of Agreement: substantial (32-56%)
- Similar to other FCE reliability studies - substantial within patiënt variance
- NDI this study: LoA ratio = 43.2%
Discussion

Results versus sample size

- COSMIN advice $n > 50$
- Excellent reliability of 3 tests, even with a notably smaller sample
- Bending / overhead reaching: $n=1$ extra needed for moderate
  Sensitivity was excellent ($ICC=0.99$)
- Repetitive side reaching: $n=8$ or $n=15$ extra needed for significance, and still poor or moderate reliability
Conclusions

1. Safety was confirmed
2. LoA were substantial in all 6 tests
3. 3 tests had excellent reliability and 3 had poor reliability
Thank you

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