Concurrent validity of the Workwell observation criteria for determination of workload during lifting in healthy subjects

FCE-Research conference, Sept 21-22-2018
Remko Soer
### Background

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<th>Muscle use</th>
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Objective

- Concurrent validity WW–observation checklist
- Motion analyses, EMG, ECG.
Instruments

- Vicon markers
- EMG
- HR monitor
Methods

• Healthy subjects.
• Cross sectional study
• Observers: fourth year physical therapy students
• Lifting low test of WWS
Hypotheses use of Musculature

- **Use of musculature with sEMG.** (SENIAM; Hermens, et al., 1999).
- **Light lifting:** primary movers (m. biceps; m. trapezius) primarily active, that secondary and tertiary musculature would be insignificant.
- **Medium lifting:** secondary muscles (M. Pectoralis Major and M. deltoideus) become active.
- **(very) heavy lifting:** primary, secondary and tertiary muscles (M. Sternocleidomastoideus; M. Levator Scapulae) become active.
Hypotheses: Base of Support

• linear increase in foot distance could be observed with increasing weight.
Hypotheses: Posture

• *Counterbalancing of Spine*

Spine extension was determined. It was expected that there would be a significant linear increase in extension with increasing weights.
Hypotheses: Heart Frequency

• Significant linear increase in heartrate with increasing weights.
Hypotheses: Movement pattern

• To detect the use of impulse, reflected on the load. Markers were fixed on the cradle.

• Velocity of first 19 centimeters while lifting it from the floor were measured.

• H1: Significant change in starting velocity between the medium and heavy weight lifting condition.
• RM–ANOVA
• Post hoc Bonferroni correction
• $P<0.05$
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<th>Characteristic</th>
<th>Men (n=8)</th>
<th>Women (n=10)</th>
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<tr>
<td>Age in years: mean (sd)</td>
<td>23 (2.8)</td>
<td>21 (1.8)</td>
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<td>Bodyweight in kg: mean (sd)</td>
<td>73 (6.9)</td>
<td>65 (10.1)</td>
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<td>Length in cm: mean (sd)</td>
<td>184 (5.2)</td>
<td>172 (4.0)</td>
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<td>Amount of kg. Lifted: mean (sd)</td>
<td>66 (3.2)</td>
<td>44 (7.4)</td>
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Results

Figure 1 a: muscle use of primary muscles

- **Biceps**
  - 1 < 2, 3, 4
  - 2 < 3

- **Trapezius**
  - 1 < 2, 3, 4
  - 2 > 1

Figure 1 b: muscle use of secondary muscles

- **Pectoralis**
  - 1 < 2, 4
  - 2 > 1

- **Deltoid**
  - 1 < 3, 4
  - 2 < 3, 4
  - 4 > 1, 2, 3

Figure 1 c: muscle use of tertiary muscles

- **Sternocleido**
  - 1 < 3, 4

- **Levator**
  - 1 < 2, 3, 4
  - 2 < 3, 4
  - 3 > 1, 2
  - 4 > 1, 2, 3

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*Y-axis: Max magnitude in mV
P < 0.01 for all analyses*
Results

Base of support

Light  Heavy  Very Heavy

P<0.01
Results

Posture

Back extension in degrees

Light  Medium  Heavy  Very Heavy

14.5  15  15.5  16  16.5  17  17.5  18
Results

Heart Rate increase (BPM)

P<0.01
Results

Movement pattern

Initial movement velocity m/s
Discussion

• Healthy subjects. Validation in patient samples needed
• Operational definition of impulse unclear. Now only velocity as proxy for impulse. No parameter for fluency of movement constructed.
• Validity of effort categories
• N=18
Conclusion

- Confirmed hypothesis on primary/secundary and base of support
- Partially confirmed hypothesis on heart rate and tertiary use of muscles
- No confirmed hypothesis on posture, movement pattern.
## Conclusion

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