Impact of dorsal extension on activation of the M. Quadriceps femoris

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The M. Quadriceps femoris
- ...is the largest and strongest muscle of the body (Tittel 2003).
- ...is important for performing activities of daily life (walking, jumping, climbing stairs, lifting weights, getting up and sitting down, ... (da Silva et al 2008).
- ...requires specific training.
Question

- Does the dorsal extension of the foot change
- ... the EMG-triggering of the M. Rectus femoris and the M. Vastus medialis?
- ... the ratio of EMG-activation between M. Biceps femoris and M. Rectus femoris?
- ... the functioning of the lower extremities (single leg hop for distance)?
The surface electromyography (SEMG)

- ... measures point in time, intensity and duration of a muscle activity.
- ... registers the entire action potential of all motor units around the electrodes (Laube 2005).
- ... calculates the root mean square value (RMS) in microvolt.

The single leg hop for distance

- ... is a physical function and performance test for the lower extremities.
- ... correlates with the force of the knee extensors (Greenberger und Paterno 1998).
Methodology

Study procedure

- Healthy test persons (age 18-60, n=35)
- **single leg hop for distance (baseline)**
- Standardized weight load (12RM; Baechle und Earle)
- Attachment of EMG-electrodes to M. Tibialis anterior, M. Biceps femoris, M. Rectus femoris, M. Vastus medialis according to the Guidelines of SENIAM (Surface EMG for non invasive assessment of muscles)
- EMG measurement on a leg press without dorsal extension at a knee angle of 45° and 90°
- **single leg hop for distance**
- EMG measurement on a leg press active dorsal extension at a knee angle of 45° and 90°
- **single leg hop for distance**
Statistics

- Descriptive statistics: arithmetic mean, standard deviation
- Effect size of jumping distance
- U-Test according to Wilcoxon, Mann and Whitney for the EMG values (RMS) and the jumping distances
Results

- single leg hop:
  - Chart (in cm)

- Effect size:
  - ES 1 - ES 2: 0,05
  - ES 2 - ES 3: 0,28
  - ES 1 - ES 3: 0,32
Results

- EMG-data (in microvolt) for knee angle of 45°

- Statistical significance for
  - Tibialis anterior*
  - Rectus femoris*
  - Vastus medialis*

![Graph showing EMG-data for knee angle of 45° with statistical significance for Tibialis anterior, Rectus femoris, and Vastus medialis.](image-url)
Results

- EMG-data (in microvolt) for knee angle of 90°
- Statistical significance for
  - Biceps femoris*
  - Tibialis anterior*
  - Rectus femoris*
  - Vastus medialis*

![Graph showing EMG data for different muscles with statistical significance marked with asterisks.](image-url)
**Results**

- Ratio between M. Biceps femoris and M. Rectus femoris

- Statist. significance for
  - 45° knee angle*
  - 90° knee angle*
Clinical relevance/Conclusion

Training on a leg press increases both the activity of the M. Quadriceps femoris in a functional muscle chain (with the dorsal extension of the foot) and the performance (jumping distance) of healthy test persons (Tassi et al 1998, Tepperman et al 1986).

Further research: applying these results to other daily activities (getting up, sitting down, climbing stair, walking,...).
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