Surface electromyography measurements of stabilizing ventral muscles in therapeutic climbing
What is therapeutical climbing?

- Adaptation from conventional sports climbing
- Highly controllable movements
- Reported positive effects in:
  - Physiotherapy
  - Psychotherapy
  - Neurology
  - Etc.

- State of the art: clinical trials, subjective outcome studies

→ Aim: attempt of quantifying and proving positive effects
Which of all exercises was chosen?

1: initial position (IP, hold)
2: transition phase (TP, loose)

Quasi-static movement
Hypotheses

- The mentioned exercise can be used for directed muscle training of the involved ventral trunk and leg muscles.
  - Extraordinary high activation of specific muscle groups

- During the exercise the patient needs to cross-activate the involved muscle groups in order not to tilt from the wall during TP.
Majorly involved muscle groups

- m. pectoralis major
- m. obliquus externus abdominis
- m. rectus abdominis
- m. rectus femoris

Adapted from: http://lawyersnaperville.org/

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Setup

- 3 subjects (2 male, 1 female, 25±1 years, height: 175±5 cm, weight: 67±8 kg)
- Therapeutic climbing wall: 15° inclined overhang
- MYON 320 Simply Wireless System, 1000 Hz + ECG electrodes

From: www.myon.ch/
From: www.ambu.de/
Routine during measurements

- Subject introduction
- Skin preparation + Electrode placement
- Individual warm-up + Practice
- Change of subjects
- 10 cycles
- 5 min break
- 10 cycles
Data Treatment

- Filtered: 4th order Butterworth, cut-off frequency of 30Hz → decrease heart muscle artefacts
- Rectified + smoothed (RMS, 300ms)
- Distinguish IP+TP from left pectoralis major

- 3 cycles per subject, 100ms each
- Mean of 300ms + std
Results – Subject 1

Subject1 (male)

Muscle Activation [μV]

- p.m. le
- p.m. ri
- o.ex. le
- o.ex. ri
- r.a. le
- r.a. ri
- r.f. le
- r.f. ri

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Results – Subject 2
Results – Subject 3

Subject3 (female)

Muscle Activation [μV]

Hold vs. Loose
Subject comparison

Subject1 (male)

Subject2 (male)

Subject3 (female)

Muscle Activation [uV]

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So what do we know now?

- Clear cross-activation
- Possible directed training of involved muscle groups
- Asymmetry during initial position

Future:
- Higher number of subjects
- Spontaneous direction of exercise
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