

Sports Equipment  
Technology

2nd International Rock Climbing Research Congress  
F. Mally, A. Sabo, F.K. Fuss

# Surface electromyography measurements of stabilizing ventral muscles in therapeutic climbing

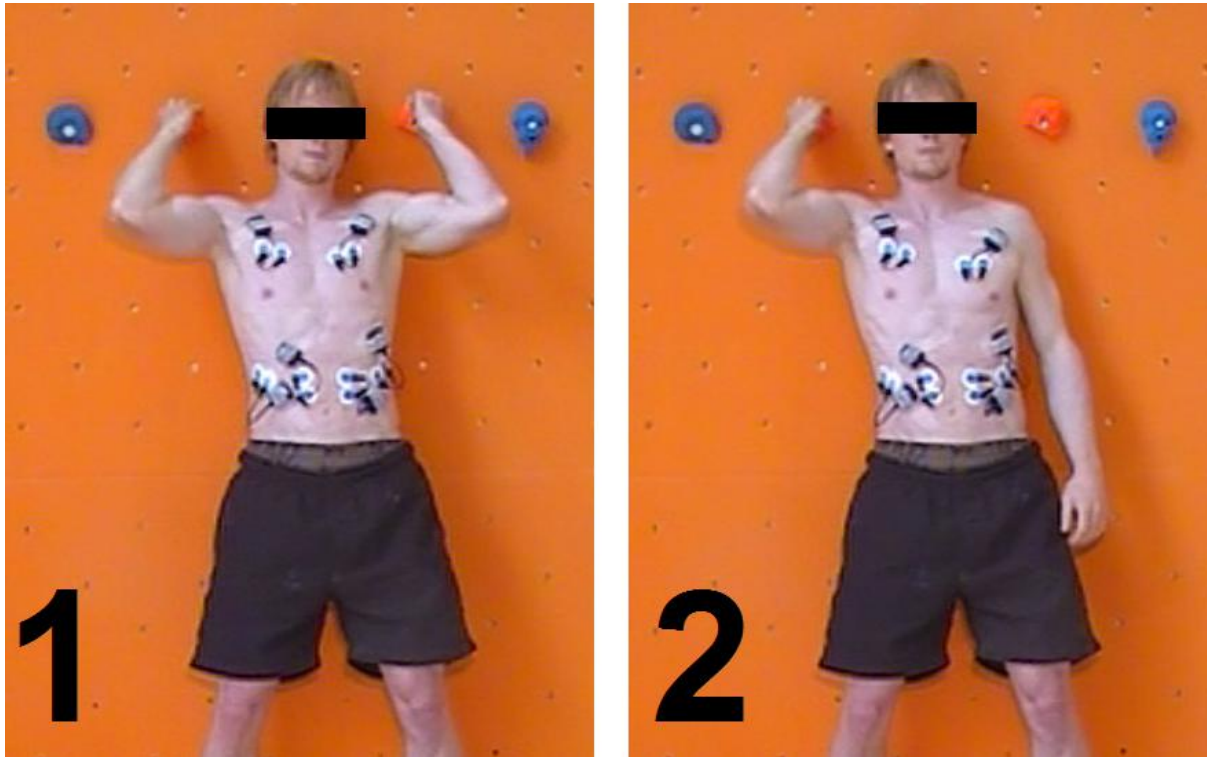
> Technology is sporting.



# What is therapeutical climbing?

- Adaption 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

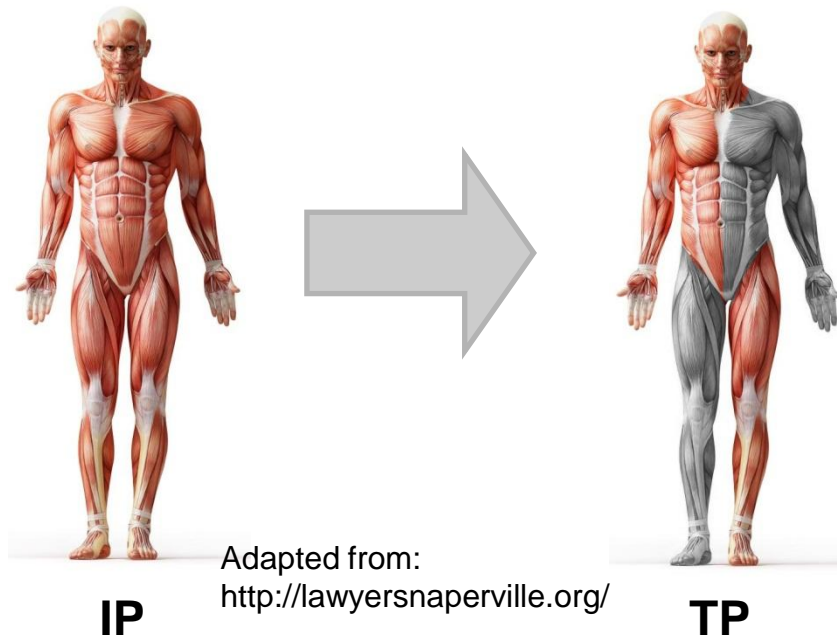
# Which of all exercises was chosen?



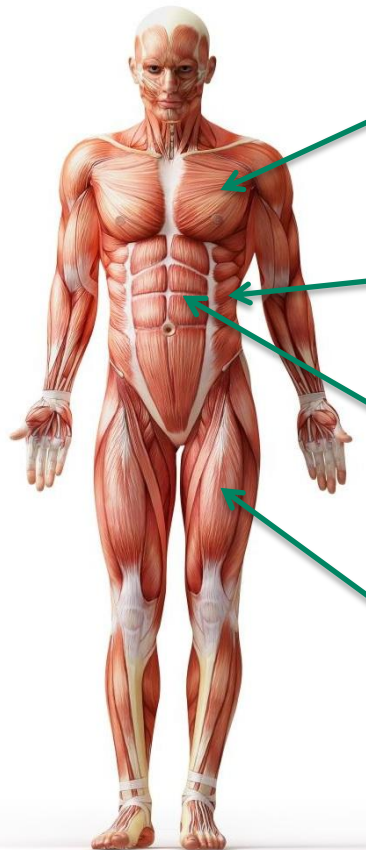
- 1: initial position (IP, hold)**  
**2: transition phase (TP, loose)**

# 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/>

# Setup

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

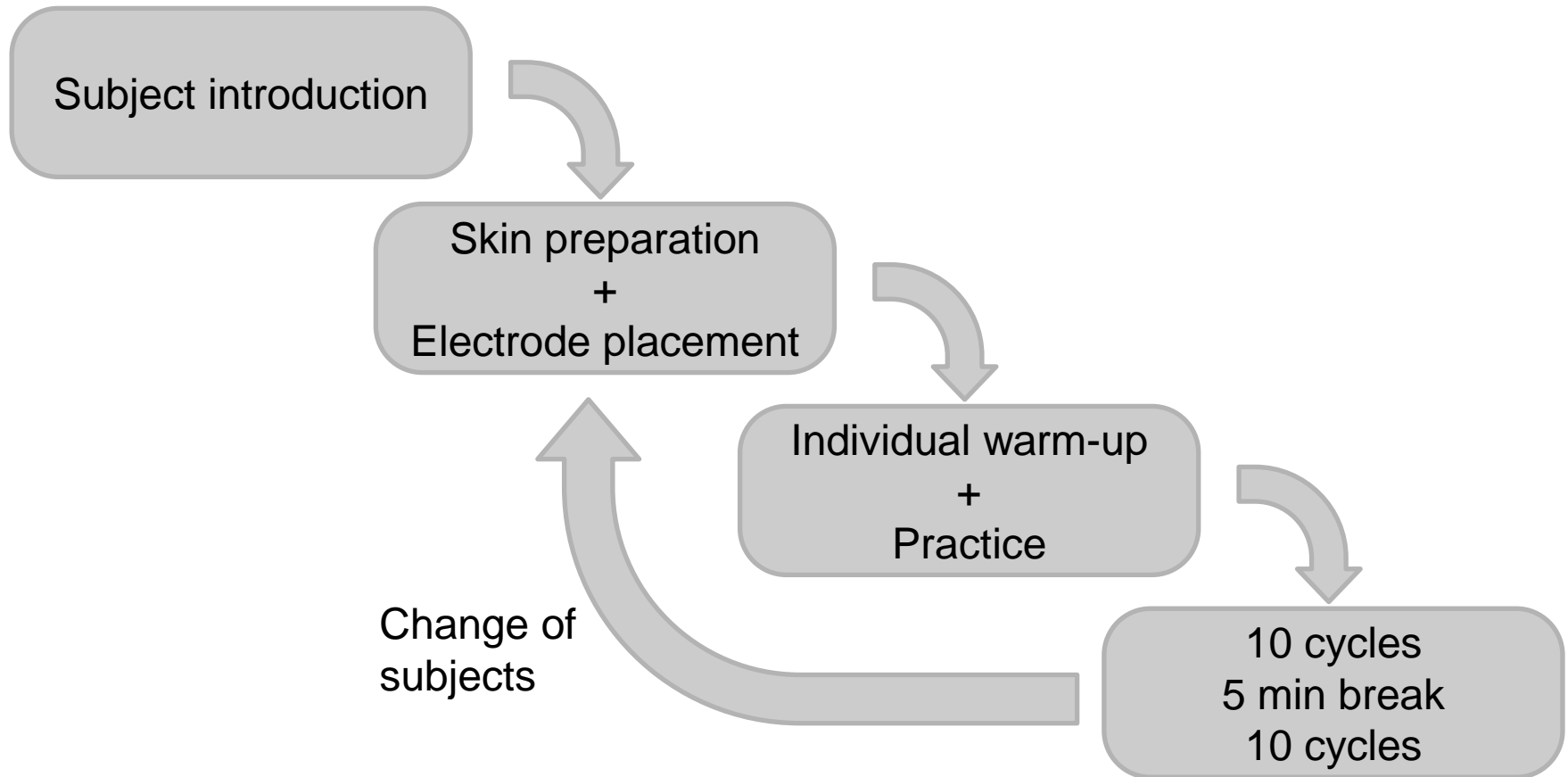


From:  
[www.myon.ch/](http://www.myon.ch/)



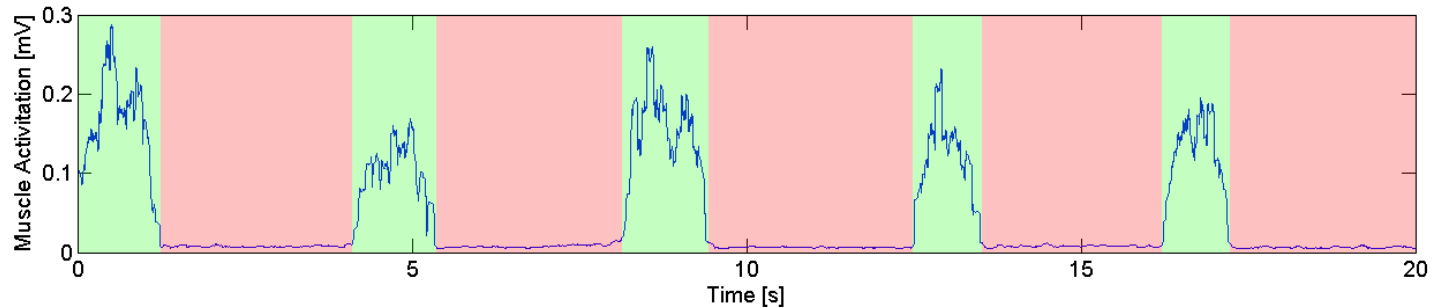
From:  
[www.ambu.de/](http://www.ambu.de/)

# Routine during measurements



# Data Treatment

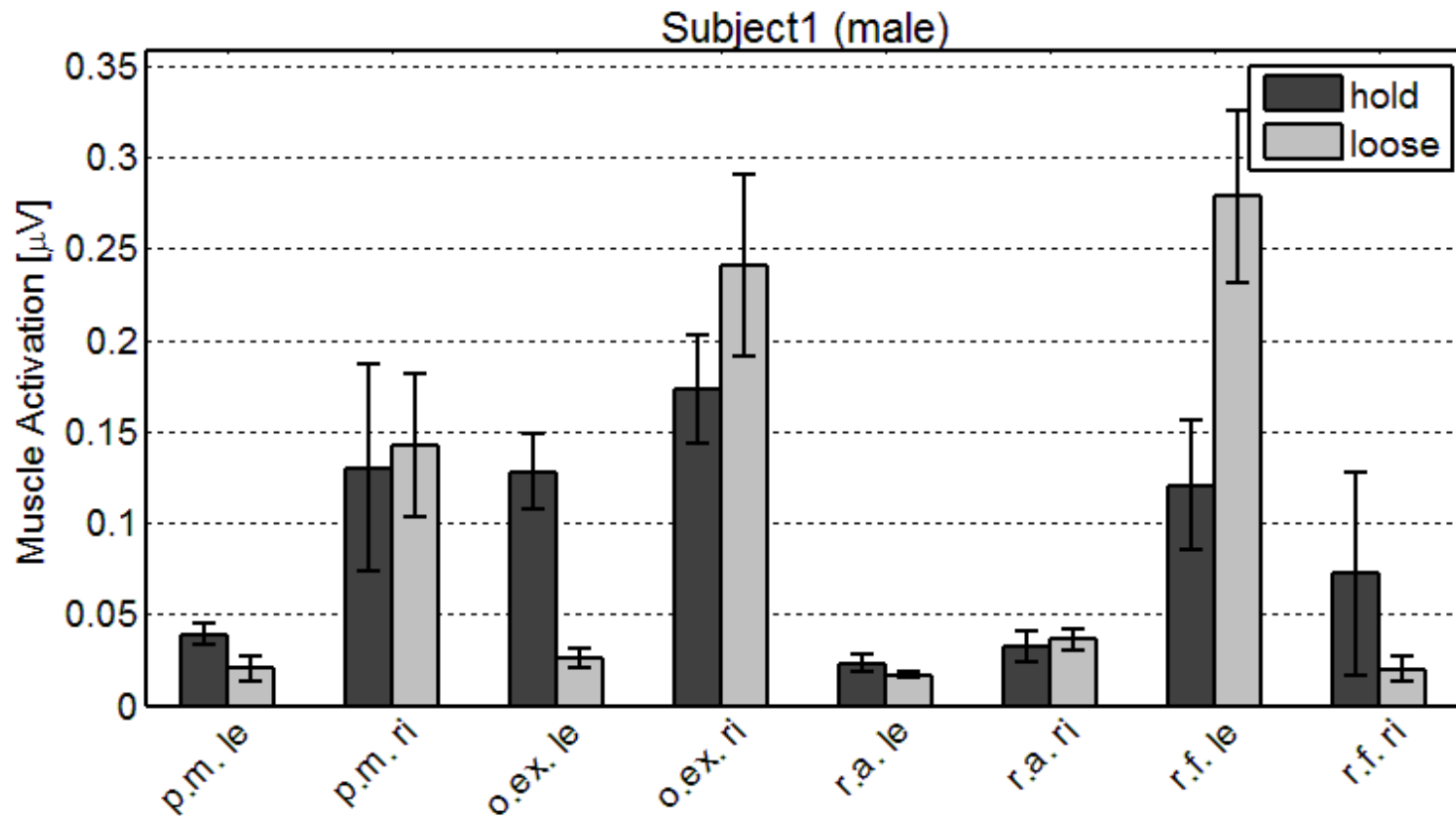
- Filtered: 4<sup>th</sup> order Butterworth, cut-off frequency of 30Hz  
→ decrease heart muscle artefacts
- Rectified + smoothed (RMS, 300ms)
- Distinguish IP+TP from left pectoralis major



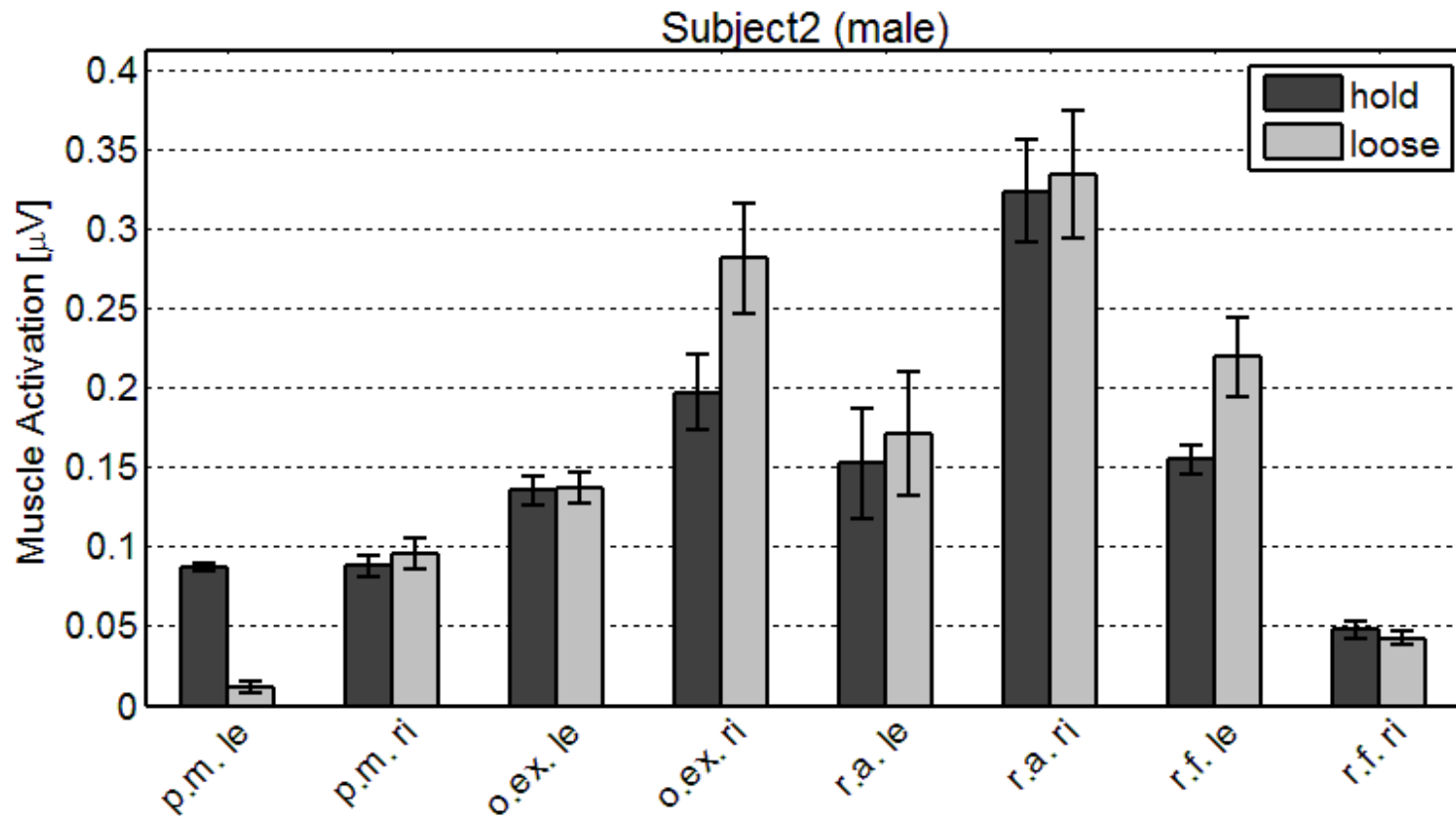
- 3 cycles per subject, 100ms each
- Mean of 300ms + std



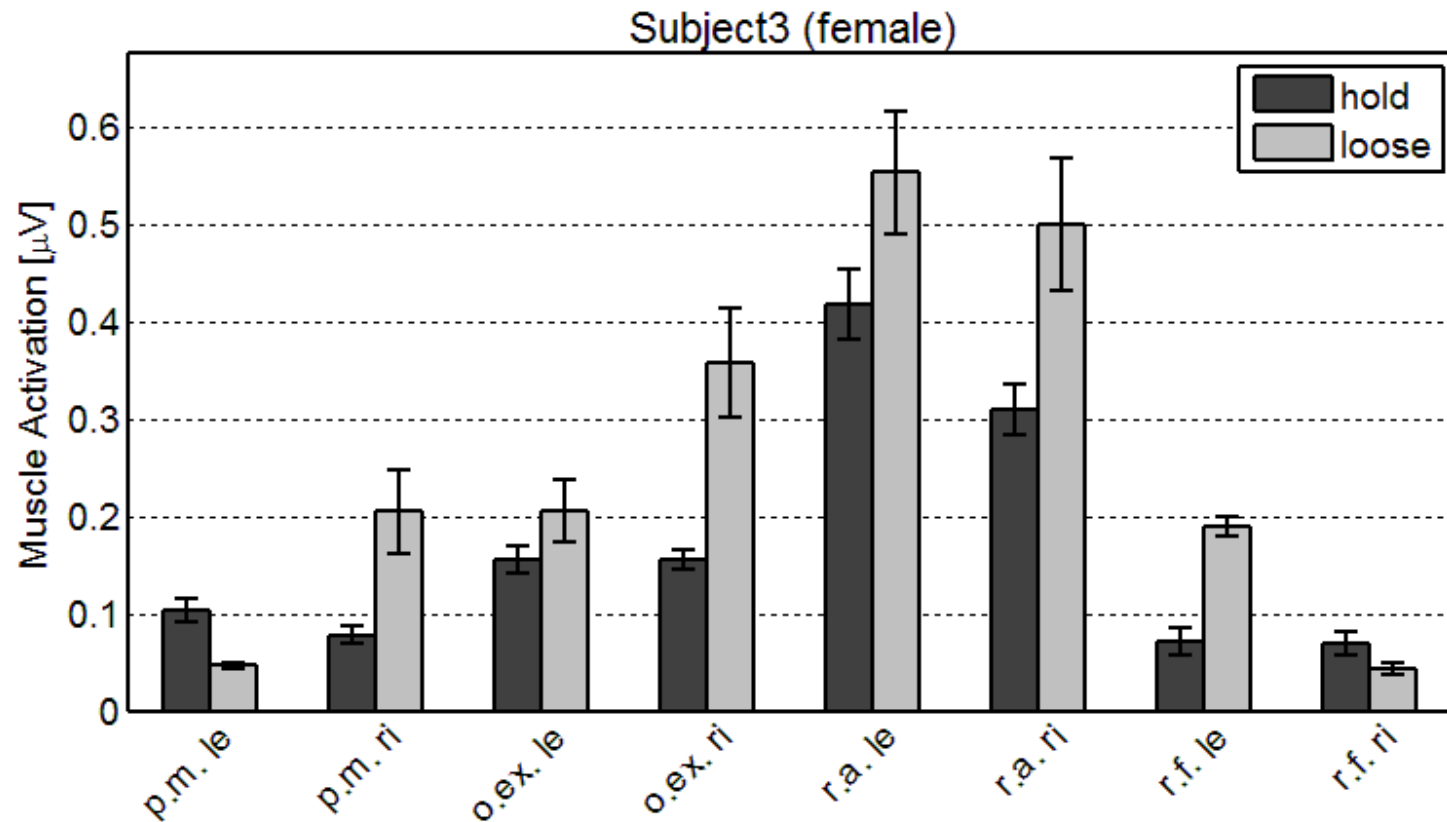
# Results – Subject 1



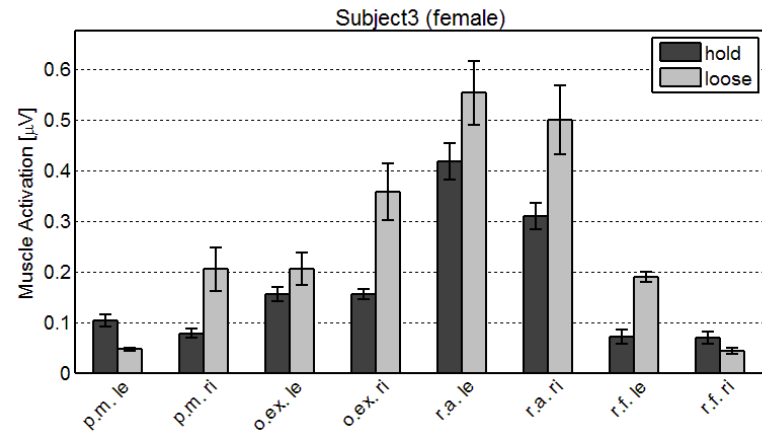
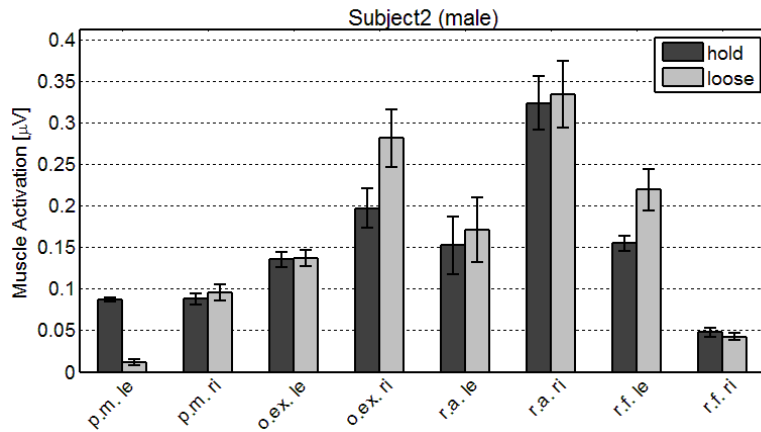
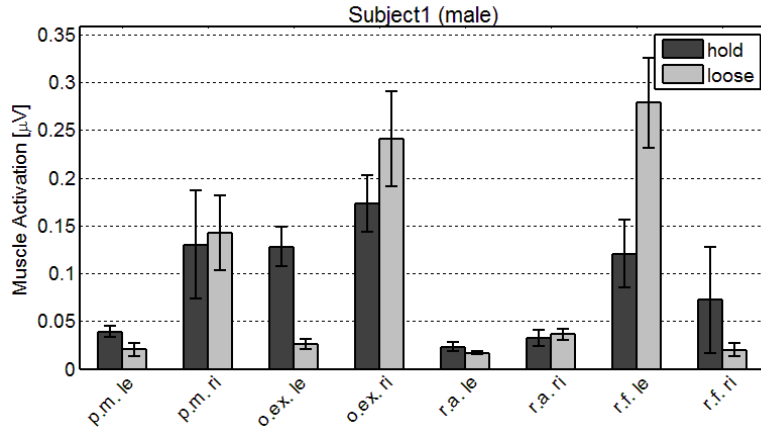
# Results – Subject 2



# Results – Subject 3



# Subject comparison



# 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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