

SMI CENTER FOR SENSORY-MOTOR INTERACTION

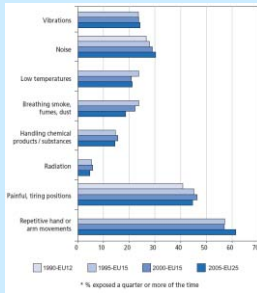
Motion og træning som smertebehandling

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Work-related musculoskeletal disorders (WMSD)



WMSD have tremendous socio-economical effects.
Cost: 0.5-2 % GNP for neck-shoulder disorders.

www.eurofound.europa.eu

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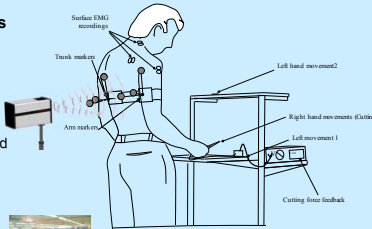
Exposure-response-effects model

Madeleine 2010 (Acta Physiol)

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Repetitive movement and pain/experience

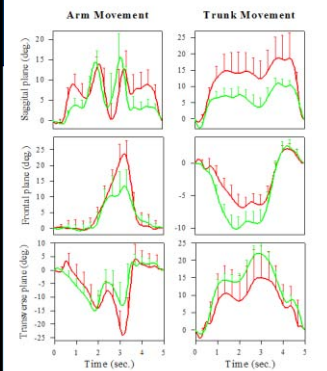
- Cross-sectional studies**
 - Acute pain (trapezius and infraspinatus)
 - Chronic shoulder pain vs. controls
- Novices vs. Experienced butchers**
- Longitudinal studies**
 - Work experience
 - Pain status



Madeleine et al. 1999, 2003ab, 2008ab (Eur J Appl Physiol, Appl Ergo, Int Arch Occup Environ Health, Exp Brain Res, Ergonomics)

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Movement and pain



Arm: chronic pain led to increased movement amplitude while the opposite occurred during sub-chronic pain

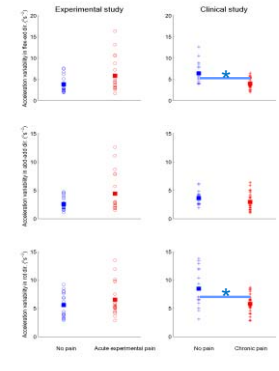
Trunk: opposite pattern

■ Controls
■ Patients

Madeleine et al. 1999 (Eur J Appl Physiol)

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Movement and pain



Size of variability (SD) of arm movement acceleration ($^{\circ}$ s $^{-2}$)

“o/o” represent subjects without/with acute pain

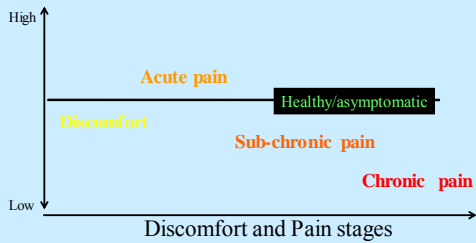
“+/*” represent controls/patients with chronic pain
*P < 0.05

Madeleine et al. 2008 (Exp Brain Res)

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Motor variability changes and discomfort/pain

Motor variability

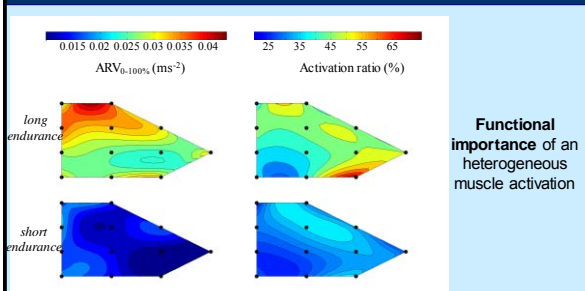


Madeleine 2010 (Acta Physiologica)

Motor variability changes and discomfort/pain

- Quantitative assessment of functional motor adaptations for benchmarking the presence of fatigue, discomfort and pain in the neck-shoulder region.

Effects of muscle activations on endurance time



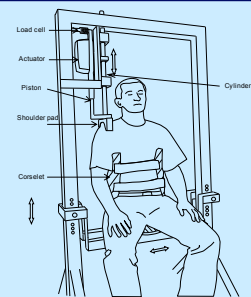
Madeleine and Farina 2008 (Eur J Appl Physiol)

Functional importance of an heterogeneous muscle activation

Effects of eccentric exercise

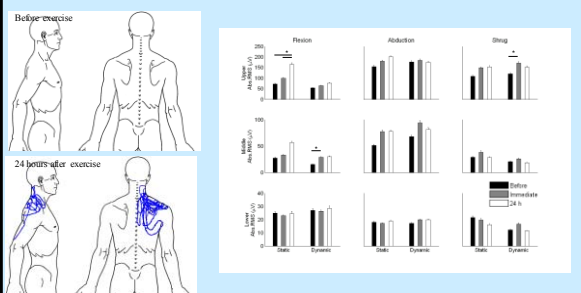
Shoulder training

- load
- movement
- repetition



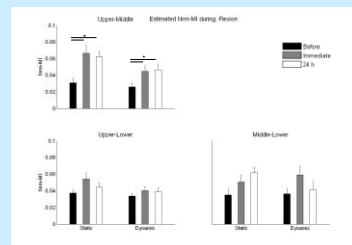
Madeleine et al/2006 (J Biomech)

Effects of eccentric exercise



Madeleine et al. 2009 (Scan J Med Sports Sci)

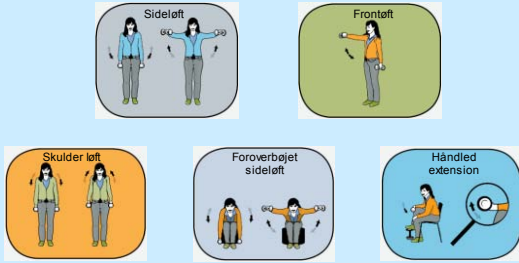
Effects of eccentric exercise



Better coordination between muscle parts after high level eccentric exercise

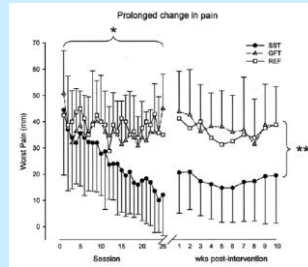
Madeleine et al. 2009 (Scan J Med Sports Sci)

Intelligent motion



Courtesy of GSjøgaard

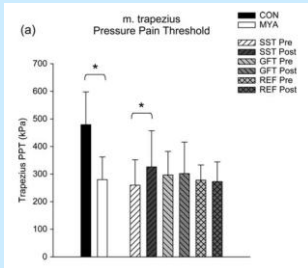
Strength training as a treatment



Decrease in pain intensity 79% (3.5 on VAS) after 10 weeks strength training

Andersen *et al.* 2008 (Arthr Reumat)

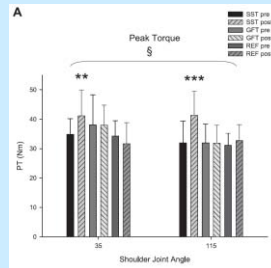
Strength training as a treatment



Decrease in Pressure pain threshold after 10 weeks strength training

Kofoed Neisen *et al.* 2010 (Muscle Nerve)

Strength training as a treatment

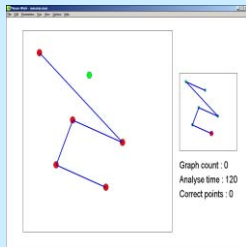


Increase in peak torque (from 61 to 115 %) after 10 weeks strength training

Andersen *et al.* 2009 (J Appl Physiol)

Active pauses as prevention

Computer work

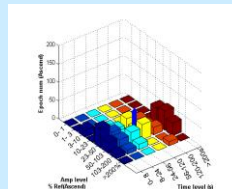
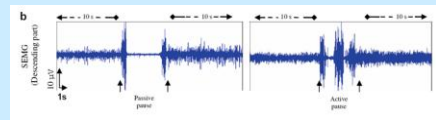


Birch *et al.* 2001 (Appl Ergo)

- Trapezius muscle parts:
- 1: Clavicular
 - 2: Descending
 - 3: Traverse
 - 4: Ascending



Active pauses as prevention



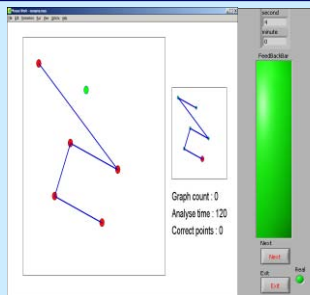
Positive effect of taking active pauses during computer work

Samani *et al.* 2009 (J Electromyogr Kinesio)

Active pauses as prevention



- Intelligent feedback system
- Dynamic reorganization of muscle synergies

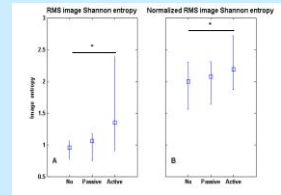
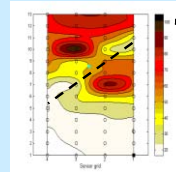


Samani *et al.* 2010a,b (Med Biol Eng Comput, Eur J Appl Physiol)

Active pauses as prevention



Increased spatial reorganization following active pauses during computer work



Samani *et al.* 2010a,b (Med Biol Eng Comput, Eur J Appl Physiol)

Motion to prevent WMSD

- **Graded exposure** i.e. motion including variations at work can be helpful to prevent and treat **work-related musculoskeletal disorders**.
- Need for development of more **advanced training programs** focusing on **motor variations** (tempo, load, repetition).