Changes in EMG activity after dry needling of the upper trapezius in patients with work related trapezius myalgia.

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http://www.webmd.com/migraines-headaches/ss/slideshow-headache-relief
Overview of the presentation

INTRODUCTION

RESEARCH QUESTION

METHODS

RESULTS

DISCUSSION

- Work-related neck pain
- Trapezius myalgia – myofascial trigger points
- EMG activity
- Dry needling

- Participants
- Protocol
- Previous research
- Interpretation
Work-related neck pain

- **Prevalence**
  - 20 – 60 % working population

- **Socio-economical burden**
  - Short to recurrent long term sick leave periods
  - Sick leave pensions
  - Early retirements

http://www.blog.friskbrisrc.com/sick-leave-benefits-norway/
Work-related neck pain

Risk factors

- Gender: ♂ > ♀
  - Organisation workplaces
  - Higher load from domestic work on ♂
  - Morphological differences
  - Differences in sex hormones

- Computer work
  - Repetitive upper limb movements
  - Work posture

- Stress

Larsson et al. (2007), Leino-Arjas et al. (2004), Ming et al. (2004)
Trapezius myalgia

Definition
- Chronic/frequent shoulder and neck pain
- Palpable tenderness UT
- Tightness UT

Pathophysiology
- Cinderella hypothesis
- Overload low threshold motor units (type 1 fibers)
- Morphological and physiological changes
- Muscle pain and fatigue

Hagberg et al. (1996), Hagg et al. (2000)
Trapezius myalgia – biopsy studies

Larger CSA type I fibers

Lower amount of capillaries/CSA in type I fibers

Higher prevalence of moth eaten fibers

De Meulemeester et al. (under review), Andersen et al. (2008), Larsson et al. (2004), Kadi et al. (1998)
Hypoxia

demand
supply

Pain
Biopsy study

Subjects

- 17 female office workers with trapezius myalgia
- 13 female office workers without neck pain

Methods

- Confocal microscopy
- Light microscopy
- Electron microscopy
Biopsy study

- **Outcome**
  - Mitochondrial morphology (size and amount)
  - Fiber type distribution and CSA
  - Capillarisation
  - Irregular fibers (moth eaten, ragged red fibers, COX negative fibers)
Myofascial trigger points

**Pathophysiology**

- Muscle overload
- Abnormal motor endplate activity/
  excessive release acetylcholine
- Sustained contraction
- Energy crisis

**Symptoms**

- Pain
- Restricted mobility
- Muscle weakness
- Disturbed muscle coordination

http://www.candidatreatment.co.uk/symptoms-of-candida-overgrowth/

Abbaszadeh-Amirdehi et al. (2013), Dommerholt et al. (2011), Sikdar et al. (2009), Gerwin et al. (2004)
EMG activity

- Definition
  - Needle EMG
  - Surface EMG

- Relation with myofascial trigger points

Ge et al. (2011), Hubbard et al. (1993), Couppe et al. (2001), Sjors et al. (2009), Leonard et al. (2010), Sjogaard et al. (2010)
Dry needling

**Treatment effects**
- ↓ Pain
- ↑ Mobility
- ↑ Quality of life

**Mechanisms of action**
- Dry needling
  - Normalised motor endplate activity
  - Muscle relaxation
  - Pain relief
  - Energy supply

**Local twitch responses**
- No LTRs: 30%
- Extinction LTRs: 55%
- One diagnostic LTR: 15%
- One diagnostic LTR: 15%
Dry needling - local twitch response

- **Definition**
  - Spinal cord reflex
  - Involuntary local muscle fiber contraction
  - Objective sign

- **Importance**
  - Larger effect on pain relief and ROM

- **Related to**
  - Speed of needle insertion
  - Clinical efficacy
  - Irritability of the MTrP
Dry needling – local twitch response

Possible mechanisms of action

- Mechanical stimulation endplate zone
  - Discharges motor units
  - Available acetylcholine
  - SEA Relaxation muscle fibers

Hong et al. (1994), Hong et al. (1998), Kietrys et al. (2013), Cagnie et al. (2013), Cagnie et al. (2015)

http://www.hdfchealth.com/top-10-tips-for-instant-relaxation.aspx
Dry needling

- Clinical studies → positive treatment effects

BUT

- Lack of knowledge about the underlying mechanisms of action
Dry needling
Research questions

1. Does dry needling have an effect on the sEMG activity of the upper trapezius in patients with work related trapezius myalgia?

2. Is there a different effect on muscles with and without local twitch responses during dry needling?
Methods

Subjects
- 24 female office workers
- 25-55 years old
- At least 20 h computer work/week
- Myofascial pain in the upper trapezius muscle (30 days/year)
- Work-related pain
- Myofascial trigger points

Materials

http://smpp.northwestern.edu/bmec66/weightlifting/emgback.html
METHODS

Protocol

Reference contraction → Typing task 1 (20') → Rest (10') → Typing task 2 (20') → Dry needling → Rest (10')

SEM activity

Baseline 1 → Post rest → Baseline 2 → Post DN1 → Post DN2

REST INTERVAL → DN 1 INTERVAL → DN 2 INTERVAL

sEMG measurement
**METHODS**

- **Signal processing**
  - Root mean square (RMS, μV)
  - Normalisation absolute values (% reference contraction)

- **Statistical analysis**
  - 3 level linear mixed model analysis
  - Random intercepts: patient, muscle and patient*muscle
  - Fixed factors: time interval, LTR, time interval*LTR
  - Covariate: duration of complaints
  - Post hoc pairwise comparisons (Bonferroni)
# RESULTS

<table>
<thead>
<tr>
<th>Demographic features</th>
<th>Mean ± SD</th>
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<tbody>
<tr>
<td>Age (y)</td>
<td>36.78 ± 9.47</td>
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<tr>
<td>Length (cm)</td>
<td>167.21 ± 5.83</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.31 ± 9.23</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>22.23 ± 2.75</td>
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<tr>
<td>Working hours (h/week)</td>
<td>40.43 ± 5.42</td>
</tr>
<tr>
<td>Duration of symptoms (m)</td>
<td>44.09 ± 42.67</td>
</tr>
<tr>
<td>NRS</td>
<td>5.13 ± 1.30</td>
</tr>
<tr>
<td>NDI</td>
<td>10.50 ± 5.43</td>
</tr>
<tr>
<td>Hours of computer work (h/week)</td>
<td>3/16/5</td>
</tr>
<tr>
<td>(20-30/30-40/ &gt;40)</td>
<td></td>
</tr>
<tr>
<td>Local twitch responses on at least one side</td>
<td>75 %</td>
</tr>
</tbody>
</table>
## Results – typing tasks

### sEMG activity (%refRMS, µV)

<table>
<thead>
<tr>
<th></th>
<th>Typing task 1</th>
<th>Typing task 2</th>
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<tbody>
<tr>
<td>Start</td>
<td></td>
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<tr>
<td>End</td>
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- **P > 0.05**

### Pain score (NRS)

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</table>

- ***P > 0.05***

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**Note:** Graphs show the trend of sEMG activity and pain score over time for typing tasks 1 and 2. Significant differences are indicated by the symbols above each graph.
Results – intervals

- No time interval*LTR interaction effect (P > 0.05)
- No main effect for LTR (P > 0.05)
- Main effect for time interval (P = 0.038)

- Significant smaller increase in sEMG activity 10 minutes after dry needling, compared to rest
- No differences between LTR or non LTR
METHODS

- Protocol

Protocol:

Reference contraction → Typing task 1 (20') → Rest (10') → Typing task 2 (20') → Dry needling → Rest (10')

- sEMG measurement
Results

sEMG activity (%refRMS)
Discussion – typing tasks

Increase in sEMG activity (%refRMS)

Increase in pain (NRS)

- Increase in sEMG activity UT and pain during sustained isometric contractions (Oberg et al. (1992))
- Increase sEMG activity UT during production-line work (Bosch et al. (2007))
- Higher sEMG activity UT during writing in subjects with trapezius myalgia (Leonard et al. (2010))
- Higher sEMG activity UT during a pegboard task in subjects with trapezius myalgia (Sjøgaard et al. (2010))
Discussion

EMG Response to Fatigue

- RMS
- Median Frequency

Cardozo et al. (2013)
Discussion - time intervals

- Unability to relax the upper trapezius after completion upper limb tasks in neck pain patients, compared to healthy controls (Kimura et al. (2007), Nederhand et al. (2002), Falla et al. (2004))

- SEA after dry needling in rabbits (Chen et al. (2001))

- sEMG activity after ischemic compression (Aguilera et al. (2009))
Discussion

No differences between LTR and non LTR group

- Differences in endplate noise → different levels of irritability
- Related to local twitch responses

Active vs latent myofascial trigger points

Kuan et al. (2007)
Limitations

- Difficult palpation due to electrodes
- No randomisation
- No control group
- Only short-term evaluation

CONCLUSION

Dry needling leads to a significantly lower increase in surface EMG activity of the upper trapezius, compared to rest, after a fatiguing typing task. This was independent of the presence of local twitch responses.
Thank you for your attention!

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http://runhaven.com/2015/09/26/im-addicted-to-needles/