Effects of Massage on Muscle Soreness and Parameters Associated With Muscle Damage Following Eccentric Exercise of the Elbow Flexors

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BACKGROUND

• Muscle Damage
• Symptoms and indicators
  ▪ Prolonged loss of muscle strength
  ▪ Reduced range of motion
  ▪ Swelling
  ▪ DOMS
  ▪ Increased in muscle proteins in the blood
Massage

• Massage is widely used as a therapeutic modality for recovery from muscle fatigue and injury (Robertson, 2004) and DOMS (Tiidus 1997)
• Massage is common among Malaysian to cure the injury
• However the results on effects of massage are varies
• Some studies found the positive effect of massage (Tiidus & Shoemaker, 1995, Hilbert at al. 2003) but others are negative or no effects (Tiidus 1997, Isabel et al 1992, Rodenburg et al 2003)

PURPOSE

To investigate the effect of specific form of massage to exercise arm at 3 hours after eccentric exercise of the elbow flexors on DOMS and parameters associated with muscle damage using the arm to arm comparison.
Experimental Design

• Arm to arm comparison where the control arm received no treatment while contralateral arm received treatments
• One randomly assigned arm underwent 10 minutes massage treatment 30 minutes post exercise
• Compared changes in markers of muscle damage between arms

Subjects

• Ethical approval
• 5 men, 5 women
  Age: 23 ± 4.2 yrs, Height: 163.2 ± 15.2 cm, Weight: 63.7 ± 11.9kg
• No history of upper arm injury
• No resistance training
• No medication, nutritional supplement
• No strenuous exercise
**Eccentric Exercise**

10 sets of 6 maximal isokinetic eccentric actions of the elbow flexors (Cybex 6000)
ROM: 90-180°, Velocity: 90°·s⁻¹
Rest: 10 s (actions) 3 min (sets)

Each arm separated by 2 weeks
Sports Massage

• 10-min sports massage by professional masseur 3 hours post exercise.
  – effleurage of the hand (30 s), wrist to elbow (1 min),
  – elbow to shoulder (1 min),
  – petrissage of the wrist to elbow (30 s), elbow to shoulder (30 s),
  – cross fibre massage to the forearm (1 min),
  – biceps, triceps, and deltoids (1 min),
  – thumb petrissage of the wrist to elbow (1 min) elbow to shoulder (1 min),
  – effleurage of the hand (30 s), wrist to elbow (1 min),
  – and elbow to shoulder (1 min).

• Effleurance refers to stroking whereas petrissage refers to kneading.
• Performed under a verbal cues recorded
• Depth and rate of massage were kept consistent

Criterion Measures

• Maximal Isometric Torque  \((90^\circ, 150^\circ)\)
• Maximal Isokinetic torque
  \((30,90,150,210,300^\circ\cdot s^{-1})\)
• Range of motion (ROM)
• Upper arm circumference (5 sites)
• Muscle soreness: palpation, extension, flexion (VAS: 0=no, 100=extremely painful)
• Plasma CK activity
• Measurements: pre, immediately post, 30-min post, 1, 2, 3, 4, 7 and 14 days post exercise
Statistical Analyses

- Changes in the criterion measures over time between conditions (Massage vs control): 2-way repeated measure ANOVA
- When a significant interaction effect (conditions x time) was found: Tukey post hoc test
- Peak muscle soreness, upper arm circumference, CK activity: paired t-test
- Significant level: p<0.05

Strength

- Baseline values for the maximal isometric and isokinetic strength showed no significant differences (P=0.93 and P=0.95, respectively) between massage and control arms. Peak torque and total work values recorded over the course of the eccentric exercise protocol were similar for the two conditions.
Muscular Strength

- No significant differences ($P=0.64$) in either maximal isometric torque at either angle or maximal isokinetic torque at the five velocities were observed between massage and control arms. Isometric torque decreased to approximately 40% of pre-exercise values immediately after exercise, and remained at this level for a further 2 days, after which there was a return to the pre-exercise level by 10-day post-exercise.
isokinetic torque

- no significant differences (P=0.82) were evident between treatment and control arms for any of the velocities tested and recovered to the pre-exercise level by 10-days after exercise for both conditions.

<table>
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<tr>
<th>Time post exercise (days)</th>
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</table>

ROM

- No significant difference (P=0.70) in the pre-exercise ROM values was evident between the control and massage arms. ROM values decreased significantly (P=0.04) immediately after exercise by approximately 30% from baseline, and did not recover for the next 4 days.
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<th>Time post exercise (days)</th>
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</table>
Upper Arm Circumference

• The baseline upper arm circumference was not significantly (P=0.74) different between arms.
• Increased significantly (P=0.04) after exercise in both conditions
• Massaged arm showed a significantly (P=0.04) smaller increase compared to the control arm
• Post-hoc analysis revealed significant differences in circumference between massage and control arm were recorded at 3 (p=0.04) and 4 days (p=0.03) following exercise.
Plasma CK Activity

- No significant difference (P=0.90) in plasma CK activity between the arms before exercise.
- Massage had a significant (P=0.03) effect on plasma CK activity following exercise.
- Smaller CK efflux occurred for the massaged arm.
Plasma creatine kinase activity before (pre) and 1-14 days after exercise for massage and control arm. * represents a significant difference between arms;

Muscle Soreness

- Muscle soreness developed after both exercise bouts.
- Peak soreness for palpation of the brachioradialis and brachialis, and flexing the elbow joint was reported 1-3 days after exercise,
- whereas soreness on extension of the elbow joint occurred 4 days after exercise
- All reports of soreness had resolved by 10 days post-exercise.
Soreness and tenderness

Peak Muscle Soreness with Palpating the Brachialis and Brachioradialis (B/radialis), and Flexing (FLX) and Extending (EXT) the Elbow Joint After Exercise for the Control and Massage Condition.

<table>
<thead>
<tr>
<th></th>
<th>Peak soreness (mm)</th>
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<tr>
<td></td>
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<td></td>
<td>SEM</td>
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<tr>
<td>MASSAGE (0-100 scale)</td>
<td>Mean</td>
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</table>

Significance level

- \( p = 0.06 \)
- \( p = 0.01 \)
- \( p = 0.07 \)
- \( p = 0.02 \)
Discussions

- Massage reducing DOMS
  - Therapeutic or prophylactic
  - stimulation of type IV muscle fibres
  - increase in lymph and blood flow

Discussions (Cont’d)

- Massage reducing CK
  - Reduce the CK efflux from the damage area by increasing circulation and lymph flow
  - Assist flushing neutrophils from injured area
  - Psychological aspect
DISCUSSION

- DOMS does not reflect the magnitude of muscle damage
- Massage reducing DOMS – might be beneficial for people who do not like DOMS

CONCLUSION

- It should be noted that massage had no effect on muscle strength and ROM and reducing swelling
- Massage following high intensity eccentric exercise reduced DOMS and lowering CK activity
Thank you very much