Effect of Sub-Occipital Instrument-Assisted Soft Tissue Mobilization on Visuomotor Reaction Time

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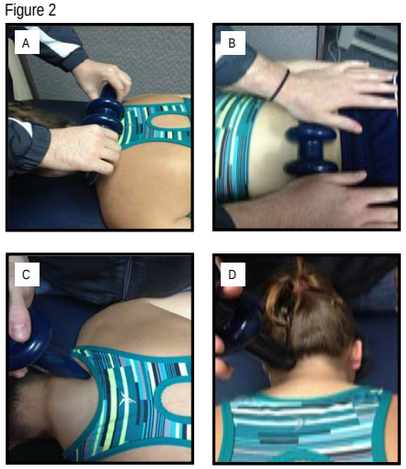
BACKGROUND AND PURPOSE

- Reaction time (RT) is an important aspect of sport performance and may be critical for injury avoidance
  - A baseball batter has approximately 200 ms to react to a fastball as it leaves a pitcher's hand[1]
  - An average of only 40 ms differentiated athletes who sustained non-contact ACL injury from matched controls[2]
- Simple visuomotor RT represents the amount of time that elapses between a single stimulus and a motor response
- Choice visuomotor RT requires more time for cognitive processing of complex visual input for a correct response[3]
  - Cerebral blood flow,[4] as well as somatosensory input from joints and muscles, may accelerate Choice RT
  - Sub-occipital muscle tension decreases blood flow within the vertebral arteries[5]
  - Research evidence supports manual therapy (MT) as an effective treatment for muscle tension[4]
- Males have been shown to exhibit significantly faster visuomotor RT than females[6]
- The purposes of this study were to assess any changes in visuomotor RT attributable to instrument-assisted soft tissue mobilization of the sub-occipital muscles or an effect attributable to gender among athletes

Figure 1

Figure 2



PARTICIPANT CHARACTERISTICS AND PROCEDURES

- Participants were 55 college students (23 males; 32 females) randomly assigned to experimental or control group
  - Control group: n=27 (16 females; 11 males); Experimental group: n=28 (16 females; 12 males)
    - Non-athletes: n=33 (21 females; 12 males); Athletes: n=22 (11 females; 11 males)
- Dynavision D2 system (Dynavision International, West Chester, OH) used to assess visuomotor RT (Figure 1)
- All participants completed a 30-s familiarization trial for each of 4 RT test modes:
  - Mode A (Proactive Simple RT): Targets remain illuminated (red) until hit; tachistoscope (T-scope) inactive
  - Mode B (Reactive Simple RT): Targets illuminated for 1 s only (red); T-scope inactive
  - Mode C (Reactive Choice RT): Targets illuminated (green or red) for 1 s, goal to hit green only; T-scope active
    - Simultaneous recitation of 1-digit numbers, each of which displayed on T-scope for 1 s
  - Mode D (Peripheral Reactive Simple RT): Targets in outer 3 rings illuminated (red) for 1 s; T-scope active
- Test trials (30 s each for all 4 modes) completed within 40 min:
  - Trial 1 (baseline), Trial 2 (10-min interval), Trial 3 (15-min interval), Trial 4 (15-min interval)
  - Mode C tests performed twice for each trial (average of the 2 values used for analysis)
- Experimental group: 10-min MT procedure between Trial 1 and Trial 2
  - Procedure utilized 7-lb MT instrument (AcuForce® 7.0, Magister Corp., Chattanooga, TN)
  - Mechanical stimuli applied to thoracic and lumbar erector spinae: rolling (Figure 2A-B) and stripping (Figure 2C)
  - Concentrated mechanical stimuli applied to trigger points from occiput to superior margin of scapulae (Figure 2D)
    - Direct pressure over trigger points; 12-s hold; distal progression in ½-in increments
    - Procedure repeated along linear path that was ½-in lateral to initial progression
- Control group participants rested for 10-min interval between Trial 1 and Trial 2
- Repeated measures ANOVA used to evaluate significance of interaction (group x trial) and main effects ($p<.05$)

Figure 3

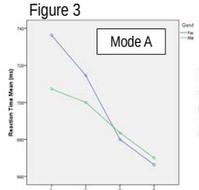


Figure 4

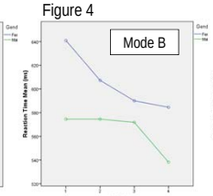


Figure 5

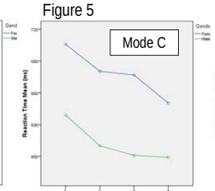
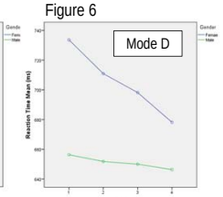


Figure 6



RESULTS

- No interaction effect or significant difference found between experimental and control groups for any trial or mode
  - MT did not have a significant effect on visuomotor RT
  - Significant differences between trials evident for all 4 test modes, indicated performance improvements
- Analysis of athletes demonstrated gender differences for 3 of the 4 test modes (Figures 3-6)
  - Mode A: no gender x trial interaction ($p=.463$); no significant gender difference across trials ($p=.773$)
  - Mode B: significant gender x trial interaction ($p=.048$); males faster than females for all trials ($p=.075$)
  - Mode C: no gender x trial interaction ($p=.295$); significant gender difference; males faster than females ($p=.005$)
  - Mode D: significant gender x trial interaction ($p=.046$); males faster than females for all trials ($p=.017$)
- Females generally demonstrated greater trial-to-trial improvements in RT for all modes compared to males

CLINICAL RELEVANCE OF FINDINGS

- Lack of MT influence on visuomotor performance may have been due to insufficient test precision to detect effect
  - Previous research demonstrating positive MT effect on neurocognitive RT suggests that visuomotor RT differs
  - Computer neurocognitive testing likely requires more complex processing of information for correct responses
- A learning effect from repeated trials was clearly evident, which differed between males and females
  - RT appears to plateau for males after approximately 3 trials, whereas RT for females continues to improve
  - An average trial 1 to trial 4 improvement of 40-70 ms across testing modes was observed for females
  - Gender-specific cognitive processing of visual information may explain different pattern of trial-to-trial change
  - Simplest task (Mode A) exhibited smallest difference; most complex task (Mode C) exhibited greatest difference
- Neuromuscular performance may be enhanced by visuomotor training, and the complexity of cognitive demands imposed by the training task (mode) may be a critical factor influencing adaptations that accelerate RT

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