Change in Neurocognitive-Reaction Time Following Sub-Occipital Manual Therapy

Arlene J. Larralde, MS, ATC; Benjamin D. Stewart, MS, ATC; Marisa A. Colston, PhD, ATC; John G. Louis, LMT

THE UNIVERSITY of TENNESSEE CHATTANOOGA

BACKGROUND AND PURPOSE

- Environmental stimuli must be processed by the central nervous system (CNS) to initiate appropriate responses
- Reaction time (RT) may be important for both avoidance of sport-related injury and optimum sport performance
  - Prolonged RT has been associated with non-contact anterior cruciate ligament injury[1]
  - A baseball batter has approximately 200 ms to react to a fastball as it leaves a pitcher's hand[2]
- Simple RT (i.e., visual-motor response) occurs faster than Choice RT (i.e., requires neurocognitive processing)[3]
  - Neurocognitive RT is associated with the amount of blood flow reaching the brain[4]
    - Muscle tension in the sub-occipital region decreases blood flow within the vertebral arteries
- Manual therapy (MT) has been advocated for treatment of conditions involving CNS dysfunction
  - Application of pressure and/or tissue mobilization; with or without an MT tool
- The purpose of this research was to determine whether or not MT focused on trigger points in sub-occipital muscles accelerates Simple "visual-motor" RT or Choice "neurocognitive" RT

Figure 1

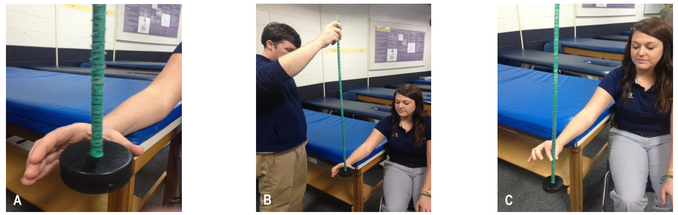
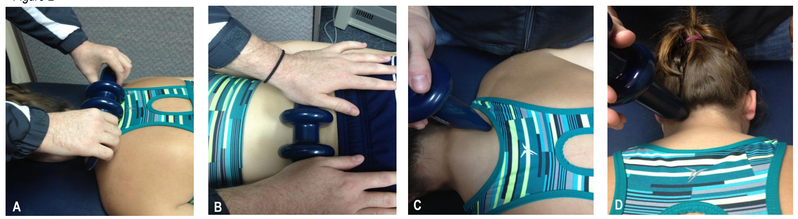


Figure 2



PARTICIPANTS AND PROCEDURES

- Participants were 54 college students (22.6 1.8 years of age); 39 females; 15 males
- Exclusionary criteria: Concussion within 6 months; cervical sprain/ strain symptoms; history of migraine headaches
- Random assignment: Control group n=27 (15 females;12 males); Experimental group n=27 (24 females; 3 males)
- Repeated measures experimental design (analysis of Group X Trial interaction effect; alpha = .05)
  - ImPACT™ neurocognitive testing program was administered to determine Choice RT - 2 trials
  - Drop-stick procedure[5] performed for calculation of Simple RT - 2 trials (Fig. 1 A-C)
    - 10 measurements recorded (thumb/ index finger position on drop-stick scale to nearest 0.5 cm)
    - First 2 drops considered practice: drops 3-10 used to calculate 8-drop average
      - Simple RT calculation: RT = 1000 √ [(2 Average Drop Distance) 980]
- Experimental group: MT procedure (AcuForce® 7.0, Magister Corp., Chattanooga, TN); 10 min (Fig. 2 A-D)
  - Mechanical stimuli applied to thoracic and lumbar erector spinae: rolling (Fig. 2A & 2B) and stripping (Fig. 2C)
  - Concentrated mechanical stimuli applied to trigger points from occiput to superior margin of scapulae (Fig. 2D)
    - Direct pressure over trigger points; 12-sec hold; distal progression in ½-inch increments
    - Procedure repeated along linear path that was ½–inch lateral to initial progression
- Control group participants rested for 10-min period (approximate duration of MT administration)
- Global Rating of Change (GRC) survey instrument administered to participants who received MT treatment

RESULTS

- Choice RT Group X Trial interaction ($F_{1,52}$=5.208; p=.027); Experimental group significantly improved (Fig.3)
  - Experimental group demonstrated slower response than Control group for Trial 1
  - Control group demonstrated relatively little change from Trial 1 to Trial 2
  - Experimental group improvement produced comparable performance between groups for Trial 2
- No Simple RT Group X Trial interaction evident ($F_{1,52}$=0.190; p=.665); comparable change for both groups (Fig. 4)
  - Significant main effect for Trials ($F_{1,52}$=9.052; p=.004); faster response for Trial 2 evident for both groups
  - No significant main effect for Group membership ($F_{1,52}$=1.492; p=.227)
- Group and gender means standard deviations for Simple RT and Choice RT presented in Tables 1 and 2
  - No gender difference apparent for either Simple RT ($F_{1,52}$=0.739; p=.394) or Choice RT ($F_{1,52}$=0.513; p=.994)

Figure 3

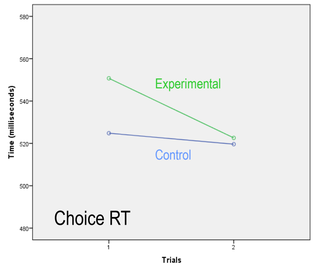


Figure 4

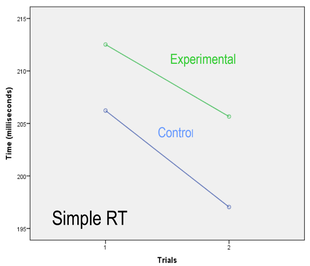


Table 1

		Trial 1	Trial 2
Simple RT	Control	206.23 ±25.00	197.04 ±20.47
	Experiment	212.52 ±28.52	205.66 ±23.12
Choice RT	Control	524.81 ±55.29	519.63 ±57.14
	Experiment	550.74 ±81.14	522.59 ±76.54

Table 2

		Trial 1	Trial 2
Simple RT	Male	205.09 ±24.84	197.12 ±16.61
	Female	211.02 ±27.59	202.97 ±23.82
Choice RT	Male	536.67 ±64.88	522.00 ±66.14
	Female	538.21 ±72.69	520.77 ±68.07

CLINICAL RELEVANCE

- MT appears to provide a beneficial effect that increases Choice RT, but no effect on Simple RT was apparent
  - Cognitive processing may be enhanced by improved blood flow attributable to the MT procedure
  - Lack of Experimental Group improvement in Simple RT probably due to differing nature of test demands
    - Simple RT only involves visual recognition of drop-stick movement and motor response
- Significant Simple RT improvement from Trial 1 to Trial 2 suggest a substantial learning effect on task performance
- Participants in Experimental Group demonstrated slower Trial 1 performance for both Simple RT and Choice RT
  - MT therapeutic effect on Choice RT seems likely, despite lack of Trial 1 equivalence between groups
- Conceivably, administration of MT focused on sub-occipital muscles may have a short-term beneficial effect on Choice RT that could improve sport-related performance capabilities and facilitate injury avoidance

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