Potential for Improvement of Visuomotor Reaction Time among Collegiate Athletes

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BACKGROUND AND PURPOSE

- Over 2 million injuries occur in NCAA sports each year[1]
- Reaction Time (RT) appears to be an important component of neuromuscular control and injury susceptibility
- Slow RT has been associated with non-contact ACL injuries[2] and core and lower extremity sprains and strains[3]
- There is a lack of research evidence to support the effectiveness of visuomotor training for improvement of RT
- The purpose of this study was to evaluate the extent to which a visuomotor training program could improve the RT of collegiate football players using the Dynavision D2 system

PARTICIPANT CHARACTERISTICS AND PROCEDURES

- 62 NCAA Division I-FCS football athletes: Age 20.6 ±1.2 years, Mass 104.1 ±19.4 kg, Height 186.7 ±5.3 cm
- Visuomotor training conducted using Dynavision D2 system (Dynavision International, West Chester, OH)
  - Board height adjusted to position tachistoscope (T-scope) at eye level (Figures 1 and 2)
  - Participant instructed to maintain visual focus on T-scope and to hit targets when illuminated
  - Assessment and training trials conducted at differing levels of task complexity

  Level 1 (Proactive) – Targets illuminated (red) until hit; T-scope inactive

  Level 2 (Reactive) – Targets illuminated (green or red) for 750 ms; T-scope inactive; goal to hit green only

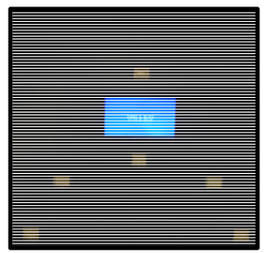
  Level 3 (Reactive) – Targets illuminated (red) for 750 ms; recitation of 5-digit numbers displayed on T-scope

  Level 4 (Proactive) – Targets illuminated (red) until hit; verbal response to simple T-scope arithmetic problems

  Level 5 (Proactive) – Targets illuminated (red) until hit; recitation of sentences displayed on T-scope
- Both pretest (baseline) and posttest (after training) assessments performed at Level 1; 60-s trial
- Group assignment based on pretest Level 1 performance; median RT=690 ms
  - Upper 50% (≤690 ms) assigned to control condition; Lower 50% (>690 ms) selected for training program
  - Training program consisted of 16 sessions over 5 ½ weeks; task complexity progressed
  - Training sessions performed for 120 s: 1-4 at Level 2, 5-8 at Level 3, 9-12 at Level 4, and 13-16 at Level 5
  - Training program compliance: 73% of participants attended all 16 sessions
  - Participants who failed to attend 50% of training sessions (n=10) reassigned as control group cases
  - 3 control participants and 7 training program participants unavailable for posttest
  - Pretest – Posttest comparison: Training group n=15; Control group n=37
- Repeated measures analysis of variance used to evaluate statistical significance of group x trial interaction (p<.05)

Figure 1

Figure 2



RESULTS

- Distributions of Pretest and Posttest RT values for training program participants (n=15) displayed in Figures 3 and 4
- Means and standard deviations for Pretest and Posttest RT presented in Table 1 (original group assignments)
- A statistically significant group x trial interaction effect was evident ($F_{1,50}$=66.5; p<.001; η^2=.57)
  - Graphic display of the interaction presented in Figure 5
- Time series graph for training program participants who completed every session (n=11) presented in Figure 6
  - As participants progressed through each level, variation in RT values attributable to changes in task complexity
  - Pretest RT=773 ±81 ms – Posttest RT=548 ±45 ms (reassignment of non-compliant players to control group)

Table 1

Participants	Pretest RT Mean ±SD	Posttest RT Mean ±SD
Untrained (n=37)	684 ±84 ms	692 ±103 ms
Trained (n=15)	791 ±87 ms	571 ±63 ms

Figure 3

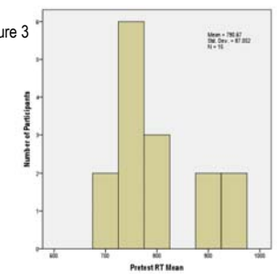


Figure 4

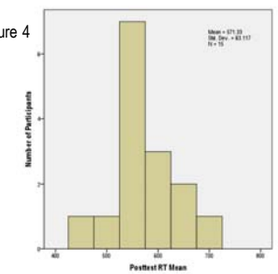


Figure 5

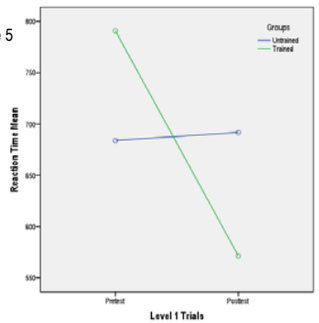
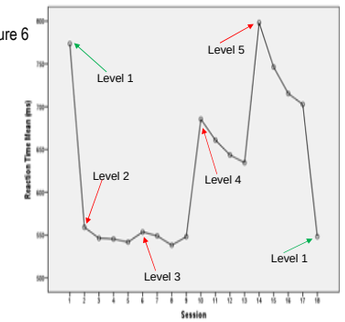


Figure 6



CLINICAL RELEVANCE

- A recent unpublished analysis demonstrated an association between RT and injury among college football players
  - Dynavision D2 Level 1 RT ≥765 ms associated with 2x greater odds for core/lower extremity sprains/strains
  - 36% sensitivity and 76% specificity for identification of injuries among 76 NCAA Division I-FCS football players
- Average RT improvement for participants who completed 8 or more of the 16 training sessions was 39%
  - All training program participants' RT Pretest values were >765 ms and all RT Posttest values were <765 ms
- Further research is needed to assess the extent to which training-induced improvement in RT is retained
  - Optimal mode, duration, and frequency of training sessions for maintenance of improved RT is unknown

REFERENCES

1. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train*. 2007;42:311-319.
2. Wilkerson GB. Neurocognitive reaction time predicts lower extremity sprains and strains. *Int J Athl Ther Train*. 2012;17:4-9.
3. Swanik CB, Covassin T, Stearne DJ, Schatz P. The relationship between neurocognitive function and noncontact anterior cruciate ligament injuries. *Am J Sports Med*. 2007;35:943-948.