Visual Training Program Effect on Visuomotor Reaction Time of College Students

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BACKGROUND AND PURPOSE

- Slow neurocognitive reaction time (RT) has been associated with increased incidence of lower extremity injuries[1,2]
  - Visuomotor RT appears to be a critical factor for impact avoidance and protective responses to external forces[3]
- More than 100 million people have uncorrected visual impairments,[4] which may adversely affect visuomotor RT
  - A perceptual-learning program can improve vision (ULTIMEYES®, Carrot Neurotechnologies, Calabasas, CA)[4]
  - Improved contrast sensitivity may decrease visuomotor RT (i.e., time from visual detection to motor response)
  - Enhancement of sport performance capabilities has been associated with traditional vision training[5]
  - More rapid detection of environmental stimuli may be facilitated by improved brain processing of visual input[6]
- The purpose of this study was to assess the possible beneficial effect of a perceptual-learning program performed on either a tablet or laptop for improvement of visuomotor RT

PARTICIPANT CHARACTERISTICS AND PROCEDURES

- Participants were 22 university graduate students (7 males; 15 females)
- Visuomotor testing 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 target buttons when illuminated
- All participants completed 2 familiarization trials for 2 different modes of test administration (60-s each):
  - Proactive mode: Target buttons illuminated until hit; T-scope inactive
  - Reactive mode: Target buttons illuminated for 1-s only; recitation of sentences scrolled across T-scope
- Pre-training and Post-training, 60-s tests performed (average of 2) for both Proactive and Reactive modes
  - Performance represented by average elapsed time (ms) between button illumination and completed response
    - Outer = 2 outer-most rings - Inner = 2 inner-most rings
- Participants completed 6-week, 24-session perceptual learning program using ULTIMEYES® software (Figure 3)
  - 24-min training sessions conducted 4 days per week
  - Devices used to complete training: 13 tablets and 12 laptops
- Repeated measures ANOVA used to evaluate pre-training to post-training visuomotor RT change (α = .05)

Figure 1

Figure 2

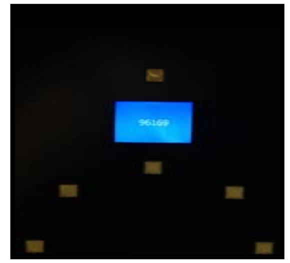
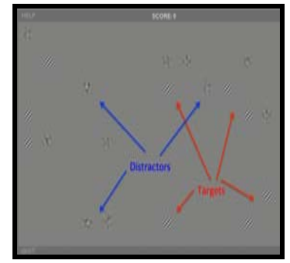


Figure 3



RESULTS

- Means and standard deviations for Pre-training and Post-training trials (2-test average) presented in Table 1
  - A statistically significant training effect was evident for Proactive-Outer RT ($F_{1,21}$=5.98; *P*=.023)
  - A statistically significant training effect was evident for Proactive-Outer:Inner Ratio ($F_{1,21}$=4.51; *P*=.046)
- Gender x Trial interaction assessed for each performance variable, none of which were statistically significant
  - Proactive-Outer:Inner Ratio interaction apparent (Figure 4), but not statistically significant ($F_{1,20}$=1.21; *P*=.284)
- Device x Trial interaction assessed for each performance variable, none of which were statistically significant

Table 1

Performance Variable	Pre-Training	Post-Training	*P*-value
Proactive-Outer RT (ms)	787 ± 123	739 ± 87	.023
Proactive-Inner RT (ms)	548 ± 51	546 ± 66	.747
Proactive-Outer:Inner RT Ratio	1.44 ± 0.19	1.36 ± 0.10	.046
Reactive-Outer RT (ms)	687 ± 63	686 ± 61	.906
Reactive-Inner RT (ms)	543 ± 58	538 ± 61	.534
Reactive-Outer:Inner RT Ratio	1.27 ± 0.07	1.28 ± 0.09	.525

Figure 4

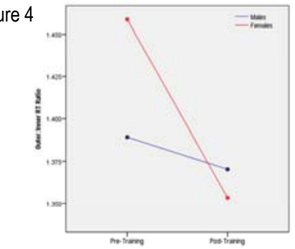
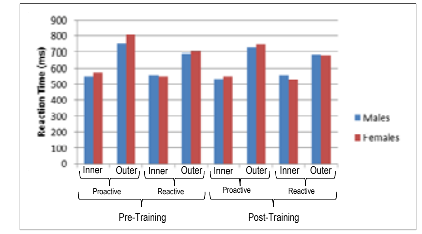


Table 2



CLINICAL RELEVANCE

- Proactive-Outer performance demonstrated significant improvement, whereas Proactive-Inner did not
  - No significant improvement observed for Reactive-Outer or Reactive-Inner performance
- Reactive test mode required central visual focus, which might have precluded rapid detection of peripheral targets
  - Proactive test mode did not require a central visual focus, which may have facilitated peripheral scanning
- Contrast sensitivity training did not appear to facilitate central-peripheral visual input processing by the brain
  - Beneficial training effect limited to more rapid detection of peripheral targets without central visual demand
- Although a statistically significant interaction was not observed, females may derive greater benefit than males
  - Previous research has documented a substantial difference between females and males for visuomotor RT
- The device used to complete contrast sensitivity training (tablet vs. laptop) did not appear to affect outcome

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