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## VIDEO GAMES FOR THE IMPROVEMENT OF REACTION TIME AND HAND EYE COORDINATION IN COLLEGE FOOTBALL PLAYERS

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### ABSTRACT

**Klicka J, Kolombus R, Weber B.** Action Video Games for the Improvement of Reaction Time and Hand-Eye Coordination in College football Players. *Journal of Undergraduate Kinesiology Online*. 2006; 2(1):55-63. **Purpose:** Sports have been a cornerstone for American youth since they were invented. As technologies have increased video games have been becoming more and more popular, today many athletes also enjoy playing video games. By combining video games with sport training athletes may have an ability to train in a comfortable and relaxing environment. The purpose of this study is to see if action video game playing can improve hand-eye coordination and reaction time in collegiate football players. **Methods:** The subjects for our study were sixteen college football players, the subjects ranged in age from eighteen to twenty-three. Half of our subjects were action video game users while the other half were not. After the original data collection they all played video games for a week. At the end of the week the subjects were retested to see if there was any improvement. The three tests that were used included the Ruler Drop Test a Pop Can Test and The Online Reaction Test. **Results:** The results from this study showed that there was no significance in improved reaction time and hand-eye coordination with increased action video game playing. The mean results for the tests performed by the non-players prior to training were as follows: online reaction time test  $M=.224$  seconds  $\pm .007$  seconds, ruler reaction time test  $M=5.47$  inches  $\pm .41$  inches, and pop can test  $M=9.25$  seconds  $\pm .30$  seconds. After training results were as follows: online reaction time test  $M=.223$  seconds  $\pm .006$  seconds, ruler test  $M=5.42$  inches  $\pm .35$  inches, and pop can test  $9.18$  seconds  $\pm .42$  seconds. Results for the players prior to testing were: online reaction time test  $.205$  seconds  $\pm .006$ , ruler test  $4.71$  inches  $\pm .14$  inches, pop can test  $7.83$  seconds  $\pm .39$  seconds. After training, times were: online reaction time test  $.205$  seconds  $\pm .007$ , ruler test  $4.84$  inches  $\pm .15$  inches, pop can test  $4.76$  seconds  $\pm .45$  seconds. **Conclusion:** Previous studies have shown that hand-eye coordination and reaction time can be improved slightly through the use of electronic games. This study is important to exercise physiology by possibly providing an alternate way to train for athletic performance.

**Key Words:** Reaction Time, Awareness, Synchronization, Feedback, Response

## **Introduction**

Coordination, physiologically defined, is the harmonious functioning of muscles or groups of muscles in the execution of movements (1). Thus hand-eye coordination is the harmonious functioning of hand and eye muscles in the execution of movements. Hand-eye coordination is a skill that comes natural to all of us as humans due to our opposable thumbs (1). Hand-eye coordination can be improved with training (2).

Many studies have been done to improve aspects of sports such as strength, speed, and endurance. For strength, comparisons of single sets versus multiple sets have been very popular (5). Studies in proprioceptive neuromuscular facilitation stretching versus static or ballistic stretching have also been very popular in testing speed and flexibility in football players (6). Becoming more and more popular over the past decade have been the effects of performance enhancing drugs, both legal and illegal in athletes. All of these tests or studies have dealt with the physical aspects of the sport and very little with the neurological or cognitive brain functions involved in the sport.

Everyone benefits from improved hand-eye coordination and reaction time, but no one more than athletes. Such things as reaction time, memory, and selective attention can all help an athlete in his/her respective sport (2). The ability to throw, catch, hit, and grab could not be done without hand-eye coordination. One type of training for improving hand-eye coordination is through the usage of action video games (3). These video games allow the user to see what is occurring in the game and react to it via the hands, and opposable thumbs. This is the harmonious functioning of hand and eye muscles to execute movements. This information provides the potential to develop better reaction time and hand-eye coordination. With these improved skills performance in sports such as football can and will be improved (4).

The purpose of this study is to see if action video game playing can improve hand-eye coordination and reaction time in collegiate football players. It is hypothesized that with increased action video game playing comes increased hand-eye coordination and improved reaction time in football players.

## **METHODS**

### **Subjects**

Our subjects are 16 male college football players ranging in age from 18 to 23. Each player volunteered after an announcement that 16 people would be needed for a research project. The subjects were split into two groups of 8. Half of the subjects were defined as video game players, and half were defined as being non-video game players. The criteria used to define the players versus the non-players were amount of playing time per week. Those who played 4 or more hours per week on average for the prior 3 months were considered to be players. Those who had played less than 4 hours on the average were considered non-players. The athletes gave their consent to participate in the research study. All the subjects know the researchers. All subjects have some experience with video games with amount of experience varying between subjects. Study was approved IRB.

### **Instrumentation**

Instruments used in this study will be a Microsoft XBOX (XBSRF-9834-56A) and Sony Playstation 2 (SPAET-5645-05T). A ruler test and Online Reaction Time Test (<http://getyourwebsitehere.com/jswb/rttest01.html>) were used to check reaction time of the subjects.

### **Procedures**

All tests were conducted in the afternoon to accommodate schedules. We separated the subjects into two groups based on hours of video games they play per week prior to this study. First we put the subjects through three basic tests. First was a ruler test, where subjects were required to catch a ruler as quickly as possible after it was dropped. The test was performed by having the subjects sit with their hand over the edge of a table with their index finger and thumb about an inch apart. A ruler was then held between and level with their fingers. A three count was used in which the ruler is dropped randomly at a point during the count. When dropped the subjects caught the ruler with their index finger and thumb. They performed this test five times to get an average score. Subjects then

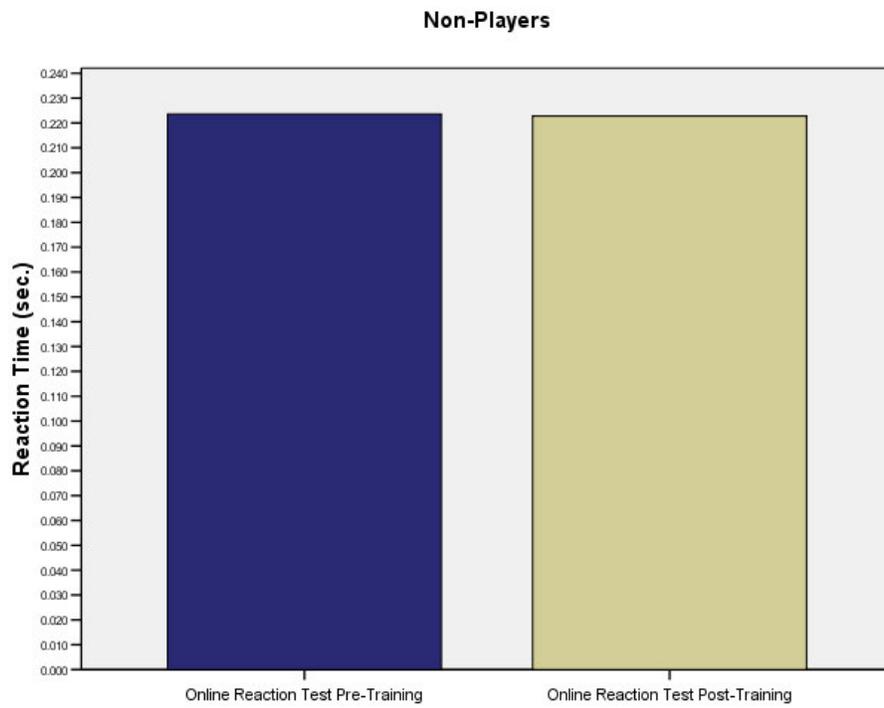
performed an online reaction time test. In this test a light changed from red to green and subjects were required to click on a box as quickly as possible when the light changes. The test had five trials to it and an average reaction time was computed after the trials are completed. Subjects then performed a pop can test for coordination. This test was set on a flat surface with a sheet of paper that has six circles (3 1/4" in diameter) in a straight line, that are five inches apart at the center of each circle. Pop cans were placed in the 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> circles. Subjects flipped the cans into the 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> circles and then flipped them back to their initial starting points. Once the pop cans were back in the original starting points the subjects repeated the process without stopping – flipping them to the open circles and then back to their original starting positions before the timer was stopped. Subjects used only one hand to perform the test. Also, if any can was placed outside of the circles the test was stopped and the subject was required to start over. Subjects performed this test five times as well. The subjects were asked to try and play four or more hours of the video games *Medal of Honor* or *Call of Duty* or a similar video game for one week. If the subjects played more than the four hours we asked them to record and report how many they played. After one week the subjects were re-tested.

### Statistical Analysis

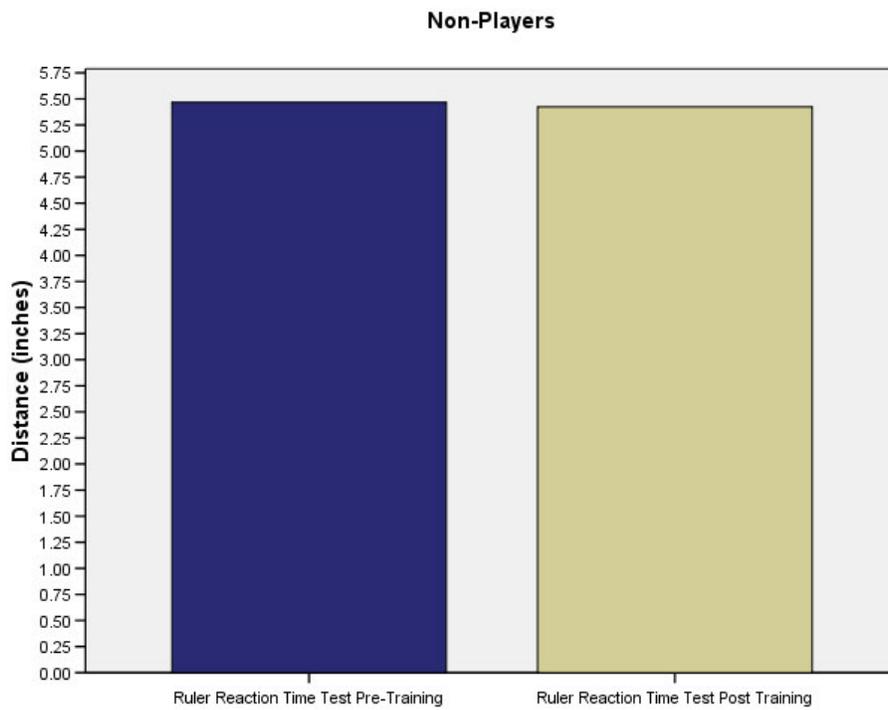
We compared the subjects scores on the video game to their times and scores on the reaction time and coordination tests to see if there is a significant difference. We also compared the initial and end test results to see if improvement was made and if there was similar improvement in both the video game and standard tests. Finally we can compare between the two groups to see if there was more improvement in the limited video-playing group compared to the group that consistently played prior to the study. Independent t-tests were performed to compare mean differences in reaction time and hand-eye coordination between regular video game players and non-video game players. Paired t-tests were performed to test for mean differences between the two groups. The level of significance was set at  $p < 0.05$ .

## RESULTS

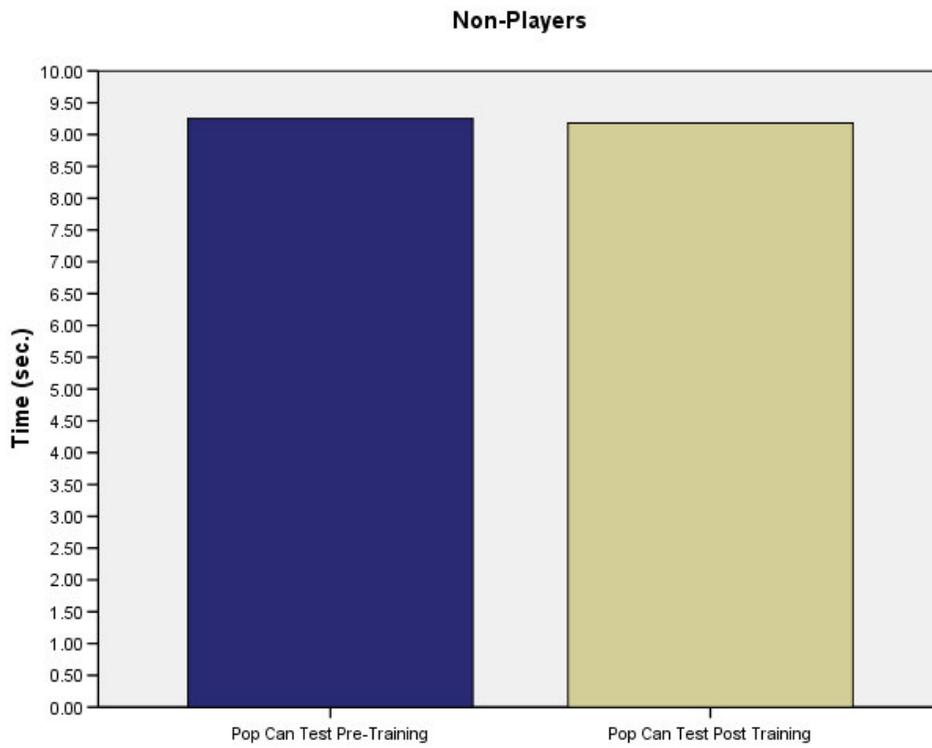
There were no significant differences in performance of non-video game players in the online reaction time test ( $M = .224$  seconds) and the post training online reaction time test ( $M = .223$  seconds).  $t(14) = .647, p \geq .05$ . There was also no significant difference in the ruler reaction time test prior to training ( $M = 5.47$  inches) versus after training ( $M = 5.42$  inches).  $t(14) = .528, p \geq .05$ . The third test of hand eye coordination using the pop can test also showed no significant improvement in performance in non-video game players prior to training ( $M = 9.25$  seconds) opposed to after training ( $M = 9.18$  seconds).  $t(14) = .266, p \geq .05$ . For the players group, there was also no significant difference in performance in the online reaction time test ( $M = .205$  seconds) and the post training online reaction time test ( $M = .205$  seconds).  $t(14) = .563, p \geq .05$ . There was no significance in the differences in the ruler reaction time test prior to training ( $M = 4.70$  inches) and the results after training ( $M = 4.85$  inches).  $t(14) = .065, p \geq .05$ . There was also no significance in the results of the pop can test prior to training ( $M = 7.83$  seconds) and following training ( $M = 7.76$  seconds).  $t(14) = .199, p \geq .05$ . When comparing the non-players to the players in terms of their average times and scores prior to and after their training there were significant differences. The players tended to have better scores and times when compared to the non-players. The players averaged .205 seconds for the online reaction test both prior to and after training ( $M = .2050$  seconds). The non players however averaged .224 and .223 seconds respectively ( $M = .2235$  seconds). This is a difference of .0185 seconds. For the ruler reaction test, the players prior to training averaged 4.71 inches, and after 4.84 inches ( $M = 4.775$  inches). The non-players averaged 5.47 inches prior to training and 5.42 inches after ( $M = 5.445$  inches.) This is a difference of .6700 inches in which the players were better. With the pop can test to show hand-eye coordination the players prior to training averaged 7.83 seconds and after 7.76 seconds ( $M = 7.795$  seconds). The non-players averaged 9.25 seconds prior, and 9.18 after training ( $M = 9.215$  seconds). This is a mean difference of 1.42 seconds. For all of these results  $p \leq .05$ .



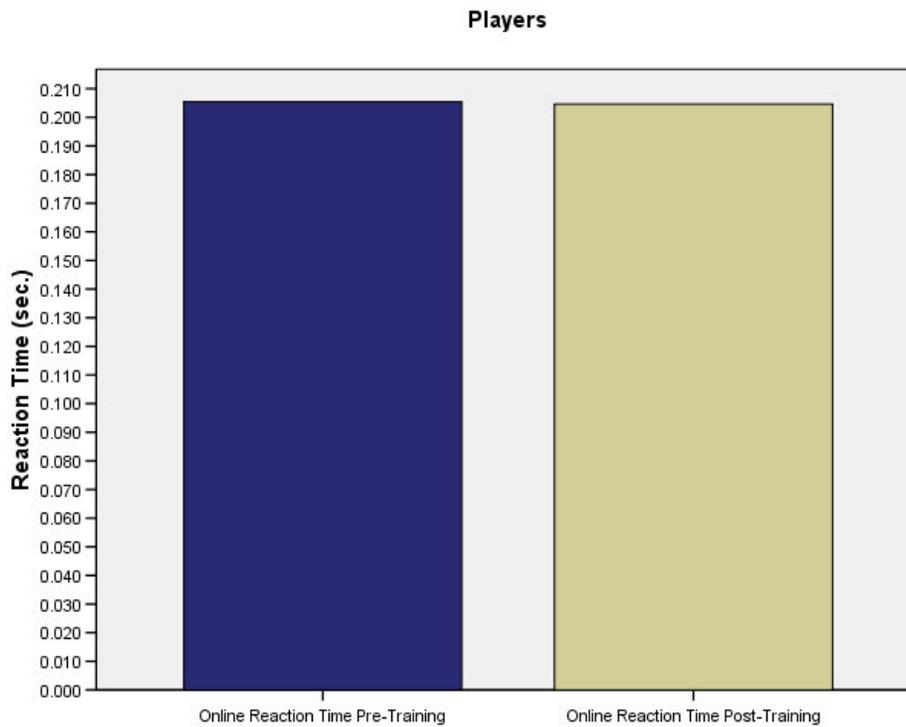
**Figure 1. Online reaction times pre and post training.**



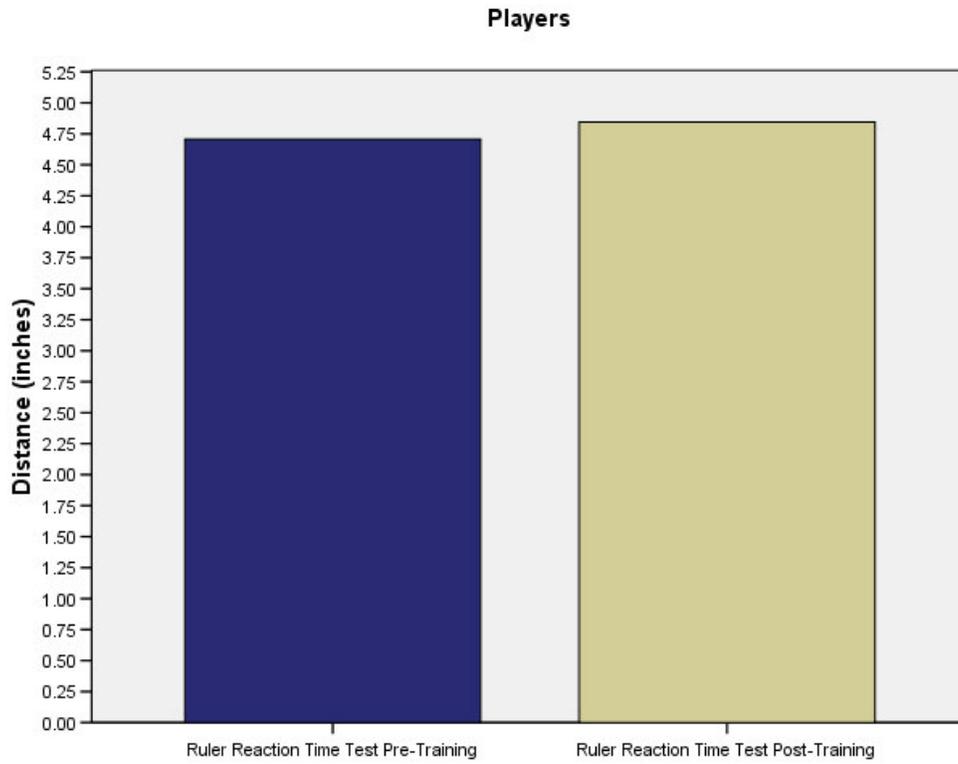
**Figure 2. Ruler test reaction results pre and post training.**



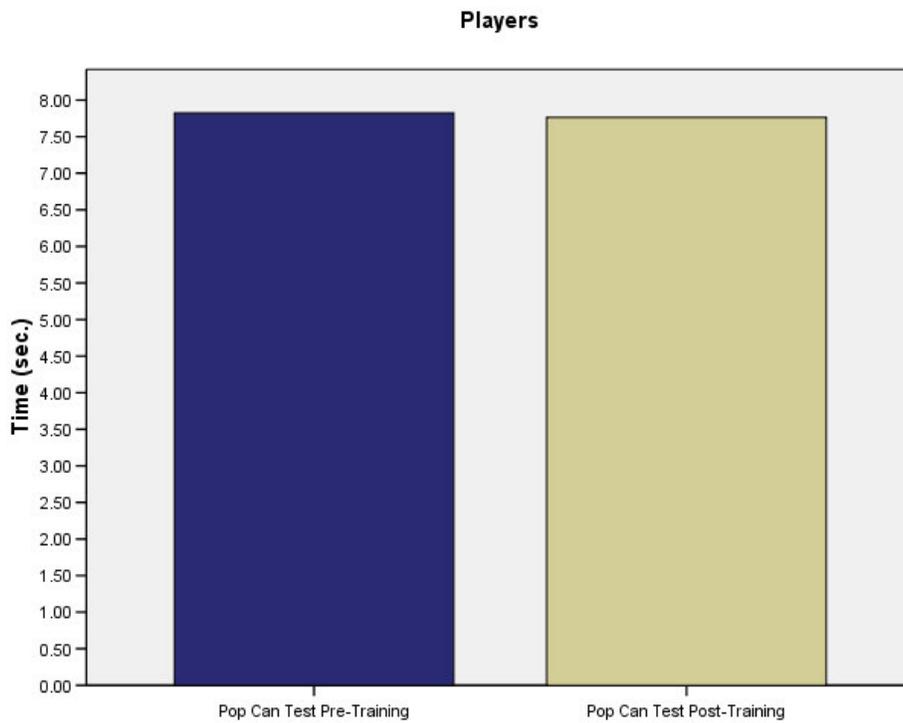
**Figure 3. Pop can test results pre and post training.**



**Figure 4. Online reaction times pre and post training.**



**Figure 5. Ruler test reaction results pre and post training.**



**Figure 6. Pop can test results pre and post training.**

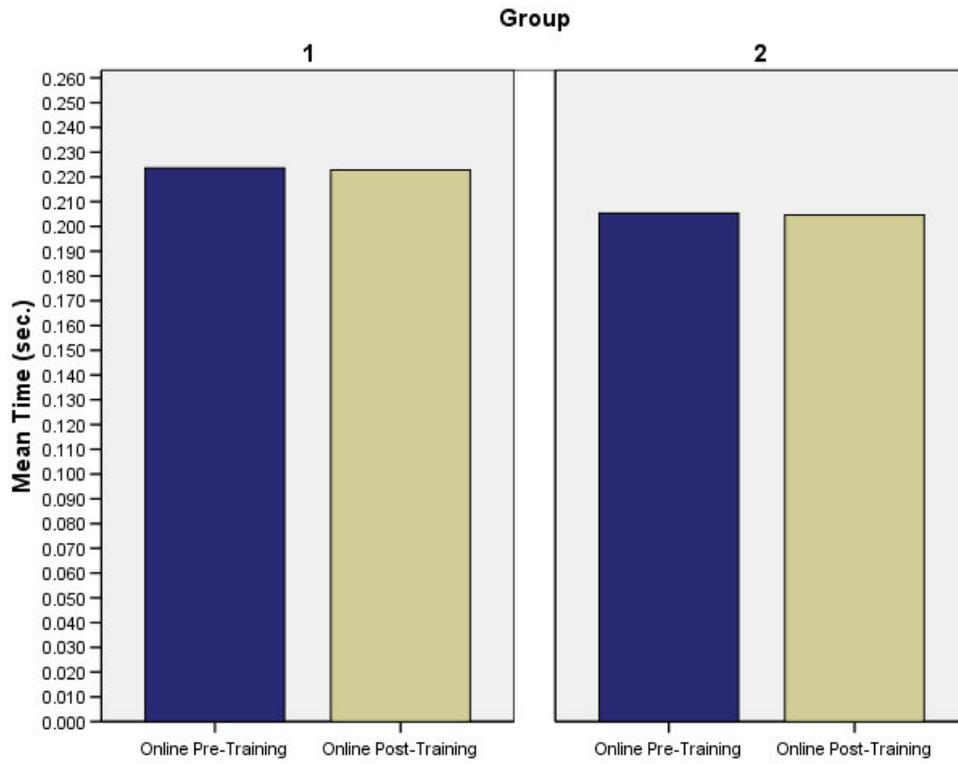


Figure 7. Group comparisons pre and post training.

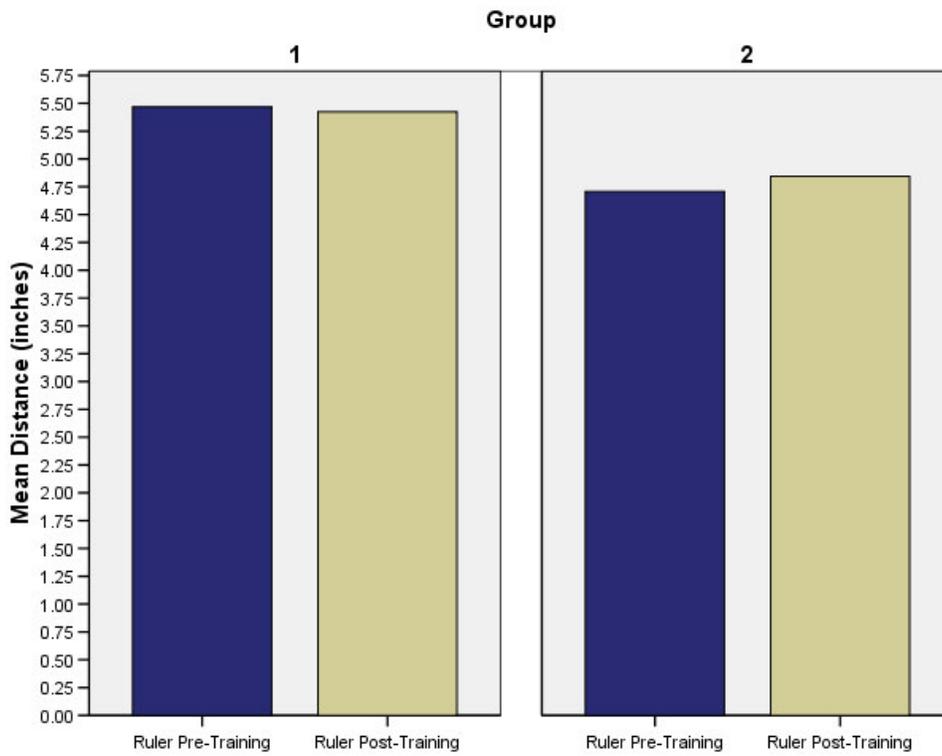
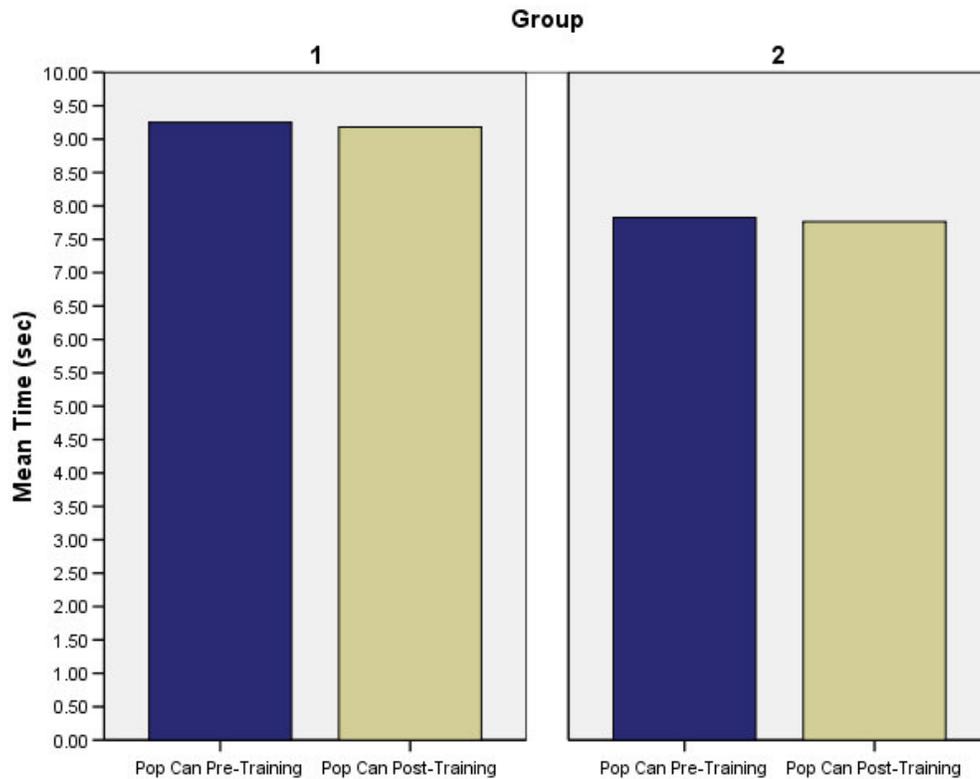


Figure 8. Group comparison pre and post training.



**Figure 9. Group comparison pre and post training.**

## DISCUSSION

The original testing for this study focused on hand-eye coordination and reaction time in two separate groups of college football players. The two groups consisted of eight players of various positions; one group (players) used action video games with a frequency of 4 or more hours per week for 3 or more months. The other group (non-players) played less than 4 hours per week for the previous 3 months. We did the initial pilot testing on our subjects and ourselves by using three different tests (2 reaction tests, 1 hand-eye coordination test); the tests were designed to measure their current hand-eye coordination and reaction time. After the original data was collected we had the groups both play action video games for a minimum of 4 hours for one a week.

After the one-week training period we once again tested both the player and non-player groups. We were looking for significant changes in the hand-eye coordination and reaction time of both groups. We were also looking to compare which group had improved their skills more. Previous findings dealing with hand-eye coordination and improvement in laparoscopic surgical skills due to video game use suggests that, video games may help to improve basic coordination and activities associated with coordination skills (4). However there have not been significant findings which show that video games can improve reaction time. Also there have been no significant studies showing that improved hand-eye coordination and reaction time can help to improve the performance of collegiate football players.

With knowledge we obtained from the study we found using video games to improve laparoscopic surgery skills (4), we predicted that there would be a significant improvement in hand-eye coordination and reaction time in the non-players group of the study, and no significant improvement in the players group. The biggest limitation of this study is that it was self-reported in terms of actual video game use by the subjects themselves, thus there is a chance the data is not as accurate as it would have been if the study was a controlled intervention study. Other limitations include, time allotted to conduct the study, accuracy of data collection by researchers, and accuracy of tests themselves. The final limitation would be the mixed groups of non-players and players in terms of

skilled positions (running backs, receivers, defensive backs, quarterbacks), and non-skill positions (offensive and defensive lineman, and linebackers). Generally it is thought that skilled position athletes have better hand-eye coordination where as offensive and defensive lineman have better reaction times due to the demands of their positions.

The results of the testing showed that there was slight improvement in all aspects for the non-players, and also in the hand-eye coordination testing in the players group. Though there were slight improvement they were not significant thus disproving our hypothesis that playing action video games would significantly improve reaction time and hand-eye coordination. Some results suggest that reaction time in players actually got worse during this study; this may have been due to the limitations listed before that were associated with this study. Since the final results did not show a significant improvement in either of the groups, further testing would be recommended. Some suggestions for further testing would include longer training period, non-player and player groups which consist of all skilled position or all non-skilled position athletes. Also more accurate tests and procedures would be suggested. A controlled setting for playing time would also benefit the results of the testing substantially. All of these changes may provide a better understanding of how the action video games can enhance performance in collegiate football players.

## CONCLUSIONS

The main finding of this study shows that increased action video game playing does slightly improve hand-eye coordination times and reaction times in collegiate football players, but not significantly. These findings could benefit coaches and athletes at all levels. By seeing these minimal changes in only a week it may lead to different types of training techniques but also the ability to include your hobby into your training. This can also be a way to break monotony of training. However, future research needs to be done to determine if the present findings can be applied as a significant training tool, not only for collegiate football players but all sports and the athletes they include.

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