International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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The effect of action and casual video games on visual reaction time and accommodation in non-gamers

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International Journal of Science and Research Archive, 2023, 10(01), 745–748

Publication history: Received on 22 August 2023; revised on 06 October 2023; accepted on 09 October 2023

Article DOI: https://doi.org/10.30574/ijsra.2023.10.1.0798

Abstract

Aim: To understand the effect of video games on non-gamers' visual reaction time (VRT) and Accommodation.

Methodology: A cross sectional study was conducted to evaluate the effect of video games on VRT and Accommodation in non-gamers. Subjects between the age of 18-28 years with BCVA 0.0 LogMAR; 0.63M were enrolled in this study. A written consent was obtained. Subjects having binocular vision anomalies, systemic diseases, learning disabilities, and dry eyes were excluded from the study. All subjects underwent a comprehensive eye exam. In addition, VRT and Accommodation were measured pre and post exposure to video games. VRT was assessed with PEBL (Psychology Experiment Building Language) and WAM open field autorefractor was used to measure Accommodation.

Result: 17 subjects (15 females and 2 males) participated in the study with the mean age of 21 ± 1.70 years. In the action video game group, mean VRT decreased significantly from 362.56±31.68ms to 348.75±31.35ms post video game exposure ($p<0.05$). The mean VRT in casual video game group pre video game exposure was 358±29.56ms and post was 353.89±26.8ms ($p>0.05$). The accommodative response exhibits a significant change, with pre-exposure mean of -0.98D and post exposure mean of -1.20D ($p<0.05$).

Conclusion: Action video games were found to enhance VRT significantly, making them a potential tool for activities requiring rapid reactions. While casual video games also improved VRT, the changes were not statistically significant. Moreover, both types of video games had a significant impact on accommodative responses, which could be clinically relevant for individuals with accommodation related issues.

Keywords: Action Video game; Casual Video game; Non gamers; Visual Reaction Time (VRT); Accommodation

1. Introduction

Over the past 30years, video games have evolved from simple and limited gaming consoles, such as the iconic Pong, to sophisticated and versatile platforms like the Xbox One and PS4. [1,2] This evolution has introduced enhanced interactivity, realism, and a vast array of gaming options, reshaping the landscape of digital entertainment. The global gaming industry has undergone a remarkable transformation over the past few decades, with mobile games now dominating the market. [3]

Studies found that action video game players exhibited improved visuospatial attention and accuracy compared to non-players. [4] Li et al. reported enhanced contrast sensitivity function in action video game players, with non-players showing improvements after gaming. [5] Shelton and Kumar compared audio and visual reaction times, observing that audio reactions were generally faster, and males had better reaction times than females. [6] These studies collectively

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illuminate the effects of video gaming on cognitive and sensory functions, providing insights into potential benefits and differences related to gaming experiences.

As video games have become an integral part of modern entertainment, understanding their effects on visual cognitive abilities is of paramount importance. In this dynamic gaming ecosystem, it is crucial to examine how video games impact the visual reaction time (VRT) and accommodation of individuals who are not habitual gamers. Hence, this study endeavours to discern the effects of video gaming on visual abilities, differentiating between action and casual gamers, thereby contributing to our understanding of the digital age's impact on cognitive functions.

2. Material and Methodology

It was a cross sectional study. The study was approved by institutional Ethical committee. The study included subjects aged 18-28 years with best corrected visual acuity 0.0 LogMAR: 0.63M. Participants were required to have no video game exposure in the past six months or more. A written consent was obtained. Subjects having binocular vision anomalies, systemic diseases, learning disabilities, and dry eyes were excluded from the study. The study proceeded through three main phases: comprehensive eye examination, visual reaction time (VRT) assessment, and Accommodation measurement. VRT was measured using the Psychology Experiment Building Language (PEBL) software, employing the simple reaction Time test. Test was conducted at 40cm distance under standard room illumination and maximum laptop screen brightness. Accommodation was evaluated using the WAM 5500 open field autorefractor.

After initial assessments, participants were randomly assigned to either an action game (PUBG) or casual game (Candy Crush) group. Baseline measurement was taken for both the group before exposing to the games. They were instructed to download the assigned games on their mobile phones and play for a total of 10 hours over 15 days (maximum 1 hour per day). Accommodation was measured daily after video game exposure, and VRT was assessed on the final day of video game exposure.

2.1. Statistical Analysis:

Data Analysis was conducted using SPSS version 29 software (IBM Corp, USA) to compare accommodative response and visual reaction time before and after gaming exposure.

3. Results

17 subjects participated in the study with the mean age of 21 ± 1.70 years. There were 15 females and 2 males.

In the action video game group, mean VRT improved significantly from 362.56±31.68ms to 348.75±31.35ms post video game exposure ($p<0.05$).

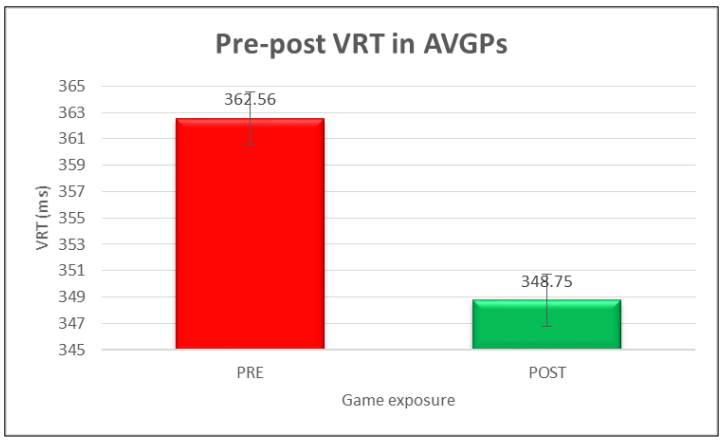

Figure 1 Mean VRT in AVGPs pre and post video game exposure

The mean VRT in casual video game group pre video game exposure was 358±29.56ms and post was 353.89±26.8ms ($p>0.05$). Wilcoxon Signed ranked test was performed to compare VRT pre and post exposure to video game and it showed no significant difference.

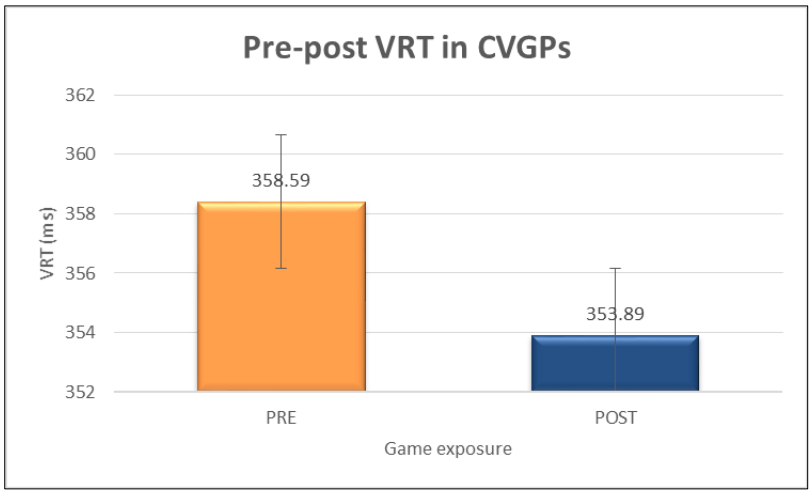

Figure 2 Mean VRT in CVGPs pre and post video game exposure

The mean accommodative response pre video game exposure was -0.98D whereas mean accommodative response post video game exposure was -1.20D. Wilcoxon signed Ranked was shoed statistically significant difference between the pre and post measurements ($p<0.05$).

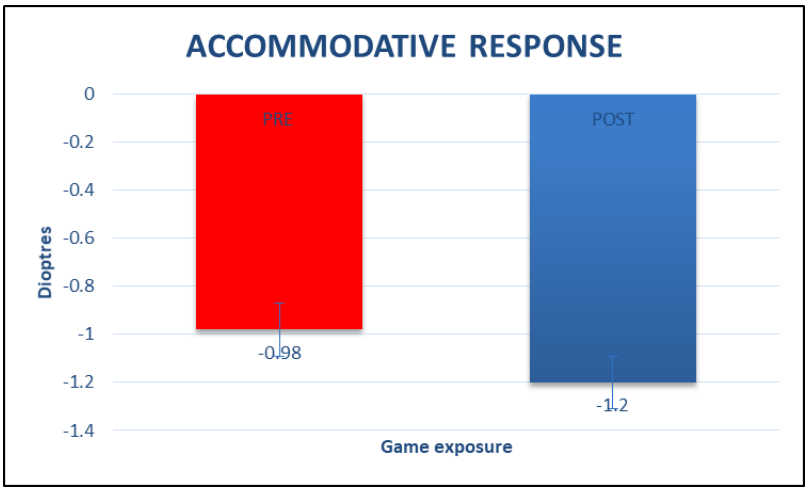

Figure 3 Mean accommodative response pre and post video game exposure

4. Discussion

In this study, we evaluated visual reaction time (VRT) before and after exposure to video games, shedding light on the specific game genres that have a notable impact on this crucial cognitive function. Previous research has indicated that video games can enhance reaction time, [7] yet the influence of distinct game type on VRT remained unexplored. Video games encompass a diverse array of genres based on their gameplay interaction, and in our investigation, non-gamers were categorized into two groups. Encouragingly, our findings revealed that VRT significantly improved following video game exposure in both categories.

Reaction time plays a pivotal role in various aspects of daily life, such as driving, participating in sports, and responding to emergency situations.[8] Certain sports, such as table tennis, volleyball, and badminton, heavily rely on rapid reaction times, making video games a potential avenue for enhancing these critical visual skills. As our results indicate a significant improvement in reaction time associated with action games, they hold promise as a therapeutic tool for augmenting VRT.

Moreover, our study demonstrated an increase in accommodation responses after video game exposure, this finding suggests that video games could be considered as a therapeutic intervention to stimulate accommodation in cases where

this visual function is compromised. Casual video games typically demand less visual attention and eye hand coordination, making them more accessible for occasional players. However, it is essential to note that casual gamers may not consistently engage with games, potentially limiting their development of faster reaction times. Enhanced visual reaction time is of particular significance in the realm of athletics, as it directly impacts an athlete's performance and competitive edge. Therefore, the potential of video games as a training tool to improve VRT in athlete's warrants further exploration and consideration.

5. Conclusion

The study suggests that playing action video games can lead to improvements in Visual Reaction Time, with a statistically significant effect observed in the action game group. Additionally, there were significant changes in accommodative responses for both near and distance targets across the entire study population.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical clearance number from the institutional ethical committee. LCOO-ETH/PG/2020/6/6-04.

Statement of informed consent

Written consent was obtained from the participants.

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Author's short Biography

Mumtaz Qazi, serving as an assistant professor at Lotus College of Optometry. Did a Master's from Lotus College of Optometry and recently got FIACLE. Heading Contact Lens, Low Vision, Community, and School Eyecare Projects.