

Project Overview

Improving jockey safety through virtual reality and biomarkers of concussion

19 October 2018 - 15 May 2020

Objectives

This project aims to improve the health and safety of Australian jockeys by developing an objective measure of concussion. To do this, our research team is testing a new virtual-reality technology concussion assessment, called CONVIRT, and identifying novel blood biomarkers of concussion. In doing so, we aim to identify an accurate 'window of vulnerability' in jockeys – a window of time following a concussion in which

jockeys are at high risk of further injury, as although the jockey may appear symptom free, the brain injury may not have resolved. As our research suggests that high stress in jockeys impairs attention and decision-making as much as having a blood alcohol content of 0.08%, the current project also aims to examine how occupational stress impacts the vision, decision-making and attention in these athletes, using CONVIRT.

Background and Project Importance

Of all sportspeople, jockeys have the highest rate of concussion and the highest fatality rate (per minute of participation). Concussion prevalence rates amongst Australian jockeys are very high, with jockeys five times more likely to sustain a concussion than AFL players. In the years 2002-2010, the average injury claim for a race-day fall involving a head injury in jockeys was \$127,127. Although concussion is the most common head injury in professional athletes, no objective concussion test exists. The long-term effects of concussion may include a variety of debilitating disease states. We seek to identify the 'window of vulnerability' to further injury in jockeys post-concussion, to prevent further injury. To achieve this, we have developed more objective measure of concussion, including blood-biomarkers and measurement of ocular speed using our new virtual-reality concussion test (CONVIRT). As long-term stress increases health risks and impairs decision-making, the project is also examining how occupational stress impacts decision-making and reaction-time in jockeys.

Results and Outcomes to date

In the first phase of the study, 105 jockeys have provided blood samples and 88 have undertaken CONVIRT testing. Eight of these jockeys sustained a concussion, and have provided follow-up blood specimens and CONVIRT testing at one day, one week, and one month following their concussion. It is too early to conduct advanced statistical analysis of the CONVIRT or blood findings, but here we provide some preliminary description from our early blood analyses.

Using a precise technology called Reverse Phase Protein Microarray (RPPM), blood biomarkers associated with concussion were counted in the blood samples taken one day, one week, and one month post-concussion. Numerous biomarkers suggestive of brain injury were found to be elevated at all three time-points. These early findings provide the first biological profile of concussion over time in professional jockeys. Follow-up results at one-year post-concussion, together with a larger sample of concussions, will provide further insight into the enduring, long-term biological changes that occur following a concussion. When these findings are coupled with the cognitive testing ascertained from the virtual reality CONVIRT concussion assessment battery, we believe we will have a very comprehensive indication of how long cognitive symptoms persist, as well as a better indication of the time required for injury resolution.



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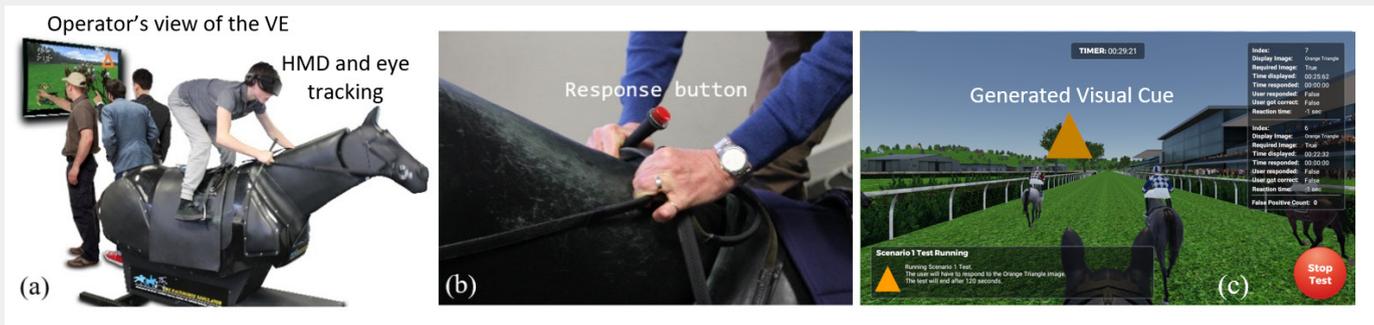


Figure 1

Virtual reality decision-making tool (CONVIRT) to be used in the project.

(a) The jockey views the virtual race track through the Head Mounted Display (HMD) and the HMD houses the eye-tracking camera to assess visual processing speed, (b) The riding crop has a custom integrated Bluetooth button to detect the jockey's response, and (c) The virtual environment (VE) shows the randomly generated geometric cues.

Implications

The project will entail a comprehensive assessment of occupational stress on decision-making. By developing an evidence-base describing the relationship between stress and decision-making, the research will inform ongoing reviews of workplace safety. Through our strong collaborative partnerships with Racing Victoria and CogState (the manufacturers of the current gold-standard technology for concussion-testing), it is likely that the present research will shape return-to-ride and fitness-to-work policy in Australian jockeys, and contribute to improved health for these athletes, by better informing diagnosis, prognosis and injury management.



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- Racing Victoria
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