

PI Profile

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BA Athletic Training, Whitworth University
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Publications:

<https://www.ncbi.nlm.nih.gov/myncbi/david.howell.1/bibliography/public/>

Overview

Dr. Howell is a distinguished alumnus of Whitworth University and the University of Oregon, completing a BA in Athletic Training, and a Master's and Ph.D. in Human Physiology. He then completed his Post-Doctoral Fellowship at Boston Children's Hospital in Sports Medicine, and is currently an Assistant Professor of Orthopedics at the University of Colorado Denver.

Research

Dr. Howell's current research focuses on diagnosis, prognosis, treatment, and prevention of injury in youth sports, with a particular interest in concussion in youth sports. Dr. Howell's research focuses on finding practical and effective treatments that improve outcomes for youth sports-related concussions.

Dr. Howell is currently the Lead Researcher at the Sports Medicine Center at the Children's Hospital Colorado.

Awards

Dr. Howell was awarded the New Investigator Award by the National Athletic Trainers Association Foundation in 2019, and by the American College of Sports Medicine in 2020.

Article Summary

“Objective Eye Tracking Deficits Following Concussion for Youth Seen in a Sports Medicine Setting”

Howell et al., 2018, *Journal Of Child Neurology*.

Background

Finding an objective and quantifiable method of diagnosis for concussions remains a challenge for clinicians. Currently, assessments for concussions involve searching for signs of disruption in sleep, balance, walking, cognition, etc. (McCrary et al., 2017). The majority of the assessments currently available, however, does not allow for an objective diagnosis, as they rely significantly on reported symptoms of the patient (which are subjective). A recent study done by Howell et al. examined visual deficits in recently concussed adolescents, and explored the potential of automated eye-tracking technology to become an objective clinical method for diagnosing concussions (Howell et al., 2018).

While other studies have already demonstrated that concussions in youth can lead to visual disturbances (Bin Zahid et al., 2018), Howell et al.'s experiment takes it a step further by working with eye-tracking technology to quantify and identify specific visual deficits in concussed adolescents.

Main Findings

This experiment was conducted with two groups: adolescents between the age of 8 and 18 who were concussed within 10 days of the experiment, and healthy adolescents between the age of 11 and 18 who were not concussed. The participants watched short videos while

sitting very still, and the automated eye tracking device was used to track their eye movements.

While many variables were measured, the researchers found that only one variable in particular showed significant differences between the concussed and non-concussed groups. Concussed adolescents showed significant signs of **skew** deviation in the right eye specifically, but not the left eye.

Skew is the amount of asymmetry around the mean trajectory of the eye (Howell et al., 2018). It can also be described as the vertical misalignment of the eyes (Hernowo & Eggenberger, 2014). In this experiment, the results showed that the right eye skew was altered for the concussion group, meaning the right eye was significantly more misaligned or asymmetrical for concussed adolescents. The left eye on the other hand, remained largely unaffected even for concussed participants; no significant differences were found between the concussion and control groups for skew in the left eye.

Significant skew deviation being exclusively in the right eye may be explained by the “eye dominance” phenomenon (Howell et al., 2018). 68 percent of people are considered to be “right eye dominant”, and may activate more of their visual cortex with the right eye. This may be the reason why only the right eye was significantly affected, as skew deviation in the left eye would have been very subtle and much harder to detect.

Advantages of Using Automated Eye-Tracking Technology

Vision tests usually need to be performed by trained physicians. This will not only make the process of diagnosis slower, but also make it

more subjective due to between-examiner differences in the interpretation of results, conditions while testing, etc. Using eye-tracking technology makes the process of diagnosis faster, more objective and quantifiable compared to other methods of vision evaluation. This would allow for earlier treatments and reduce long term effects post-concussion. Additionally, eye-tracking technology can catch subtle visual deficits that may be undetected by clinicians; this would lead to a more accurate diagnosis.

Statistical Analyses

A multiple linear regression model was used to predict symptom severity, symptom count, dizziness, and light sensitivity by inputting data from eye tracking variables. P value of <0.05 was used to determine significance. For the full statistical analysis, please refer to the original article [here](#).

Limitations

Limitations of the study that were mentioned:

-Since the subjects consisted exclusively of adolescents from a regional area, it cannot necessarily be applied to the general population.

-Eye tracking results may have been affected by participants with ADD or ADHD.

-**Skew** was the only metric that showed significant results; all other variables did not show significant differences between concussion and control groups.

Future Directions

While using eye-tracking technology may be an improved method of identifying visual deficits in concussed adolescents, it should not be used

independently. Rather, eye-tracking technology should be used in addition to the pre-existing visual assessments to improve diagnosis. More research needs to be conducted in order to apply the results of the experiment to the general population, as the experiment was performed exclusively on adolescents.

Conclusion

The amount of asymmetry around the mean of the eye trajectory (**skew**) while watching a video was significantly altered in the right eye of adolescents who had suffered a concussion within 10 days of testing. The study shows that eye-tracking technology could potentially be an objective way to clinically identify post concussion vision deficits, but more research needs to be done in this area.

References

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If you are an organization, school, or society and would like to raise awareness and support for the Concussion Diagnosis Project, please contact us.

AS A RESEARCHER

If you have expertise in studying brain injury, please join our growing group of collaborators.

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