

MICROSCOPIC INVOLUNTARY MOTION INDICATES SUB-CONCUSSIVE BRAIN INJURY IN MALE RUGBY UNION PLAYERS

Introduction

Emerging evidence suggests that sub-concussive injuries significantly impact brain health in later life. Research found correlations between repeated concussion in rugby players and a greater likelihood of developing dementia, motor neurone disease and Parkinson's disease¹.



With concussion incidence rising yearly in rugby union², finding ways to monitor blows to the head could help to reduce the likelihood of developing such diseases.

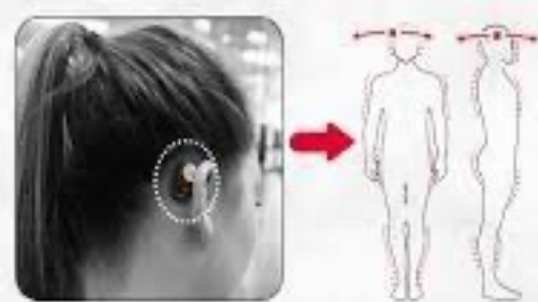
Aims of the Research

- To see if sub-concussive injuries can be monitored non-invasively.
- To assess whether sub-concussive injury correlates with an increased reporting of concussion symptoms.

Methodology

20 male participants from Lancaster University Men's rugby union team were tested at rest (baseline), after a 1-hour resistance workout (control) and a full contact rugby union training session.

The PROTX sensor was placed behind the ear whilst participants stood still for 1-min eyes open and 1-min eyes closed.



The Rivermead Post-concussion symptoms Questionnaire was completed after both conditions to record symptoms of concussion.

Findings

Control trial

Postural sway was not significantly different during eyes open (+0.007W, $p > 0.05$) or eyes closed (+0.019W, $p > 0.05$) when compared to baseline measures. This suggests that the 1-hour resistance session did not elicit any physiological changes that represented a sub-concussive injury.

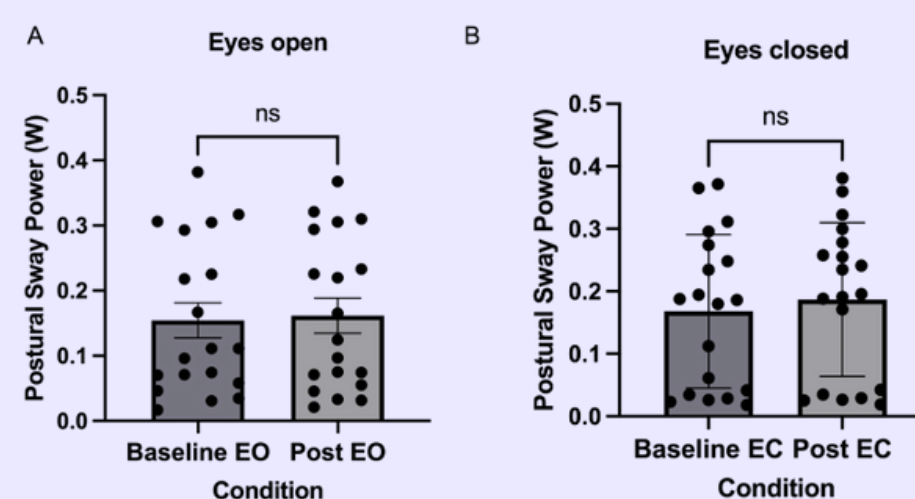


Figure 2. Graph showing paired t-test results for postural sway power (W) for eyes open (A) and closed (B). ns = not significant.

Experimental trial

Postural sway was significantly increased following the full contact rugby union session. The eyes open condition saw an increase in postural sway of +0.137W, $p < 0.001$, whilst the eyes closed condition saw an increase of +0.107W, $p < 0.001$ when compared to baseline.

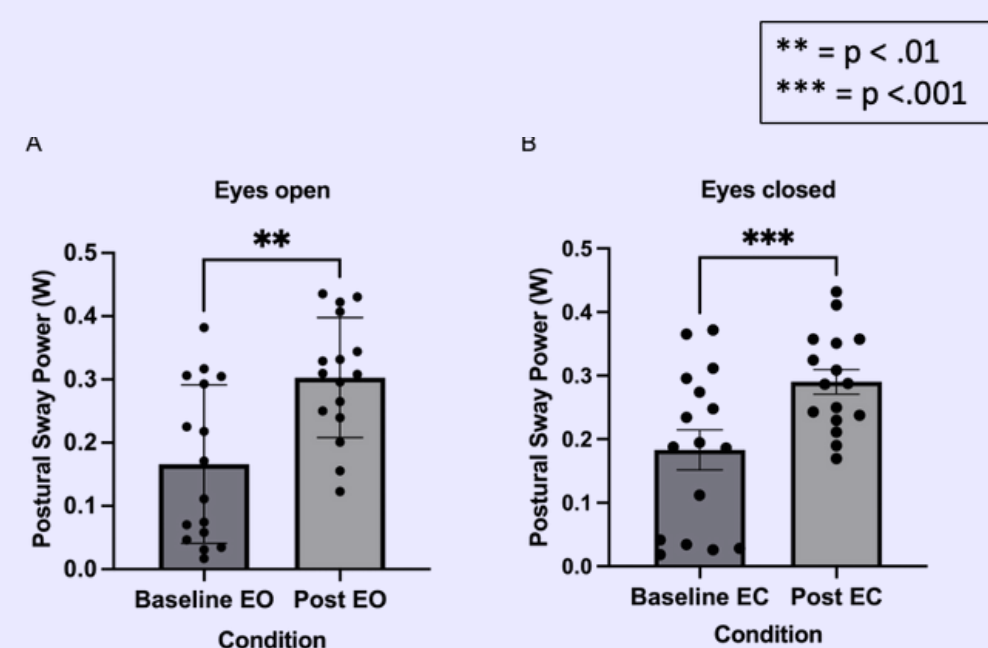
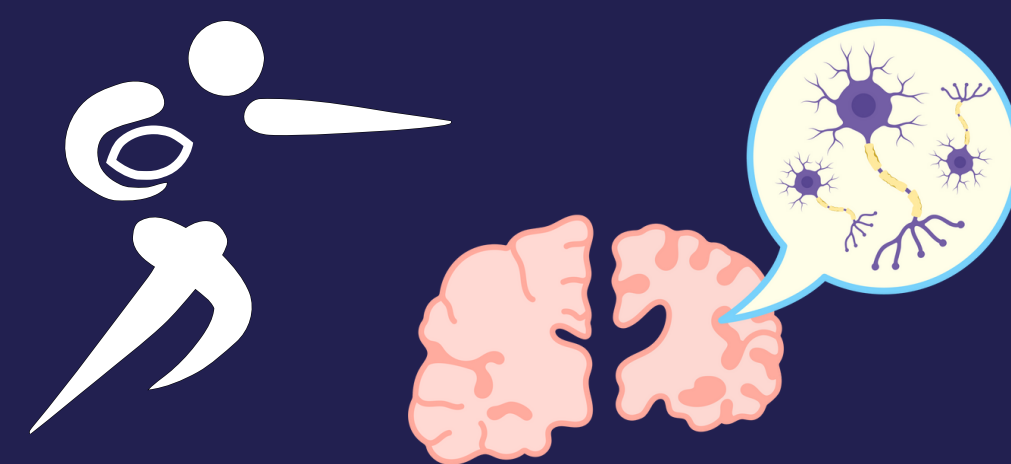


Figure 3. Graph showing paired t-test results for postural sway power (W) for eyes open (A) and closed (B).

Postural sway was correlated with an increase in symptoms of concussion reported on the RPQ for both eyes open ($R^2 = 0.23$, $p < 0.05$) and eyes closed ($R^2 = 0.34$, $p < 0.01$).



Conclusion

This study shows that contact training in rugby union is associated with decreased postural stability, alongside an increase in concussion symptoms, suggesting sub-concussive injuries were present. The PROTX sensor has potential utility to diagnose sub-concussive injuries in rugby union.

PROTX sensors could be used to monitor impact load throughout the season, preventing players from sustaining numerous sub-concussive head injuries, reducing long term effects of repeated sub-concussions such as dementia or Alzheimer's.



Key Findings

- Significant increase in postural sway following rugby union training session for both eyes open and closed conditions.
- Increased postural sway positively correlated with an increase in concussion symptoms reported.

Acknowledgements

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References

1. Russell, E.R., Mackay, D.F., Lyall, D., Stewart, K., MacLean, J.A., Robson, J., Pell, J.P. and Stewart, W., (2022). Neurodegenerative disease risk among former international rugby union players. *Journal of Neurology, Neurosurgery & Psychiatry*.
2. West, S.W., Starling, L., Kemp, S., Williams, S., Cross, M., Taylor, A., Brooks, J.H. and Stokes, K.A., (2021). Trends in match injury risk in professional male rugby union: a 16-season review of 10 851 match injuries in the English Premiership (2002-2019): the Professional Rugby Injury Surveillance Project. *British journal of sports medicine*, 55(12), pp.676-682.

Figure 1. PROTX Physiological Vibration Acceleration Sensor (PROTX, 2023)