



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

REBECCA KENNY

BSc (Hons) (University of Oregon, 2014)

**“Do Sub-Concussive Impacts from Soccer Heading in Practice Cause
Changes in Brain Structure and Function?”**

Interdisciplinary Studies

Wednesday, August 29th, 2018
10:00 a.m.
Medical Sciences Building
Room 210

Supervisory Committee:

Dr. Brian Christie, School of Exercise Science, Physical and Health Education, University of Victoria
(Co-Supervisor)

Dr. Jodie Gawryluk, Department of Psychology, University of Victoria (Co-Supervisor)

External Examiner:

Dr. Patrick Nahirney, Division of Medical Sciences, University of Victoria

Chair of Oral Examination:

Dr. Elisabeth Gugl, Department of Economics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Background: Heading is an important part of soccer, yet recent research has indicated that cumulative effects of repetitive heading may cause sub-concussive injury (Koerte et al., 2015). Objective: The current study aimed to prospectively investigate the effects of repetitive, intentional heading in soccer practice on brain structure, cognitive function and heart rate variability using a within-subjects design.

Methods: Participants included 10 soccer players (20.5 ± 2.84) that were examined immediately pre and post heading practice. Magnetic resonance imaging data were acquired on a 3T GE Scanner with diffusion tensor imaging (DTI). Behavioural measures were also completed pre and post soccer heading and included the SCAT-3 and several short-computerized executive function tasks. An accelerometer was used to measure the force of the impact during soccer heading. Heart-rate data was collected on Polar Monitors. DTI analyses were completed using FSL's Tract Based Spatial Statistics to examine changes in both fractional anisotropy (FA) and mean diffusivity (MD) due to heading the soccer ball. The current study investigated microstructural changes and behavioural performance in young soccer players. Heart rate variability data were not available for analyses due to technical difficulties. Results: Heading impacts were not greater than 10g. At this level of impact, there were no significant pre-post heading differences in either FA or MD. There were no significant differences pre-post heading in the three behavioural tasks. Additionally, there were no significant differences in SCAT-3 scores between groups. Some practice effects were demonstrated in one behavioural task and a section of the SCAT-3.

Conclusion: The current work shows initial evidence that repetitive heading in soccer in a practice setting does not cause changes in brain structure or cognitive function. Future research should investigate heading in games and sex differences with a greater sample size.