My Thesis Title

by

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LIST OF ABBREVIATIONS

AMPA α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid

AAN American Academy of Neurology

ADD Attention deficit disorder

ADHD Attention deficit hyperactivity disorder

AE Athletic exposures

ANOVA Analysis of variance

ATP Adenosine triphosphate

BNA Brain Network Analysis

BOLD Blood-oxygen-level dependent

CER Comparative effectiveness research

CISG Concussion in Sport Group

CSF Cerebrospinal fluid

CTE Chronic traumatic encephalopathy

DKI Diffusion kurtotis imaging

DLPFC Dorsolateral prefrontal cortex

DTI Diffusion tensor imaging

EEG Electroencephalogram

EGI Electro-Geodesics Inc.

ERN Event-related negativity

ERP Event-related potentials

FA Fractional anisotropy

FFT Fast-Fourier transformation

FLAIR Fluid attenuated inversion recovery

fMRI Functional magnetic resonance imaging

GLM General linear models

GoC Correct/Go (ERP Condition)

GoI Incorrect/Go (ERP Condition)

GSI Gadd severity index

HBI Health behavior inventory

HIC15 Head injury criterion

HITS Head Impact Telemetry System

HITsp Head Impact Technology severity profile

LME Linear mixed effects

MANOVA Multivariate analysis of variance

MD Mean diffusivity

MRI Magnetic resonance imaging

ms milliseconds

mTBI Mild traumatic brain injury

NMDA N-Methyl-D-aspartic acid

Na-K Sodium-potassium

NgC Correct/No-Go (ERP Condition)

NgI Incorrect/No-Go (ERP Condition)

NIOSHA National Institute for Occupational Safety and Health

Pe Post-error positivity

P-values Probability values

qEEG Quantitative electroencephalograph

RSHI Repeated subclinical head impacts

RWECP combined-probability risk-weighted cumulative exposure

SRC Sport-related concussion

SWLS Satisfaction With Life Survey

TBH Time between hits

TBI Traumatic brain injury

TPM Two-photon microscopy

VMPFC Ventral medial prefrontal cortex

ABSTRACT

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Chair: Professor Steven P. Broglio

Background Concussions occur at a rate of seven million annually within high school athletics, where football is responsible for the largest proportion of these injuries among all sports. Literature suggests that both concussion history and exposure to repeated subclinical head impacts may lead to long term declines in brain function. The length of exposure to result in these effects has mostly been observed in adult athletes using very large (e.g. lifetime) windows of exposure. **Objective** The objective of the current study is to investigate changes in ERP components across the course of a season of exposure in contact and non-contact groups of high school athletes. The relationship between any potential changes measures in ERP components and repeated subclinical head impacts within the contact sport group will also be elucidated. **Methods** 24 athletes were included in the study (Twelve football and twelve non-contact athletes). Athletes underwent testing prior to the season, at mid-season and at the end of the season. Event-related potential components were calculated during an auditory Go/No-Go task while participants were equipped with a 256 electrode EEG. Football athletes were also equipped with helmets which recorded the magnitude and frequency of impacts over the course of a season. **Results** Changes in N2 and P3 latency between each athlete type were seen across the course of the season. N2 latency for both athlete types was significantly influenced by the number of previous diagnosed concussions. Within the football athletes, linear impact density was shown to significantly influence changes in P3b that occurred across the season. This measure may help classify contact sport athlete sensitivity to incur concussive injuries. **Conclusion** The results from this study indicate that contact and non-contact athletes show differential changes in brain components over the course of a season of exposure. Changes within the contact group may be explained in part by the magnitude of head impact biomechanics incurred over that time.