

Differences in ability to balance and anxiety trends in college athletes – contact vs. Noncontact sports

Abstract

Background: Traumatic brain injuries (TBI) have been shown to affect a multitude of functions throughout the body. Evidence has demonstrated that increased feelings of anxiety and trouble maintaining balance is often affected by a TBI. Hard contact in sports may result in diagnosed concussions, but impacts that do not result in the clinical diagnosis of a concussion can be classified as subconcussive, or below clinical concussion diagnosis. Brain damage as the result of subconcussive contact may induce similar symptoms of an acute TBI that can hinder cognitive and/or physical functioning.

Purpose: The aim of this study was to determine if differences exist among athletes in contact vs. noncontact sports, specifically focusing on balance and anxiety.

Methods: Sixteen college aged (21.5±1.8) student-athletes (10 contact, 6 noncontact) participated in this study. Subjects completed the Generalized Anxiety Disorder 7-item (GAD-7) self-assessment and the Modified Clinical Test of Sensory Interaction in Balance (m-CTSIB) to measure anxiety and balance, respectively. The m-CTSIB test involved 4 sensory integration balance tests, each lasting 30 seconds (firm surface-eyes open, firm surface- eyes closed; soft surface-eyes open, soft surface- eyes closed). Soft surface balance tests utilized a foam pad. All data was collected in a single, 30-minute session, in which the GAD-7 and m-CTSIB were measured respectively.

Results: Based on the results of a Paired Samples T-test, there was a significant ($p=0.05$) difference between contact and noncontact sports and their m-CTSIB ($p=.001$). There was no significant difference ($p=0.05$) between sport grouping and GAD-7 scores ($p=.113$).

Conclusion: Data from this study suggests that contact sport athletes may experience subconcussive trauma more frequently than noncontact sport athletes, leading to a reduced ability to maintain balance. The lack of significance between sport grouping and GAD-7 scores indicate that subconcussive and concussive trauma may affect the brain differently in terms of anxiety. Findings indicate the importance of using balance ability to test trauma in contact sport athletes.

Keywords: anxiety, balance, contact sports, noncontact sports, traumatic brain injury, concussion, gad-7, m-CTSIB

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Introduction

College athletes experience many injuries per year while competing in National Collegiate Athletic Association (NCAA) athletics. One study found that athletes experience more than 12,500 injuries per year while competing in college athletics.¹ In addition, previous research has shown that immediately after a head/brain injury, anxiety levels increase,² and one's ability to balance decreases.³ To our knowledge, there is a gap in the research when testing anxiety levels and balance after a season of contact sport and/or recovery from a previous head injury. Previous research has also shown that repetitive subconcussive impacts over a season can lead to deficiencies in brain function.⁴ We are looking at the consequences of contact sports without the official diagnosis of a traumatic brain injury (TBI)/concussion. For this reason, participants in our study cannot be currently diagnosed with a TBI, had one in the last 12 months, or have 4 or more diagnosed TBIs. We are using athletes in both contact and non-contact sports to compare BioSway CTSIB scores, Burns Anxiety Inventory, and GAD-7 scores. The determination of a relationship between contact sport athletes, decreased ability to balance, and increased levels of anxiety could help athletes understand the effect of their sport on their bodies and the importance of fully recovering from their season.

Material and methods

Sixteen college aged (21.5±1.8) student-athletes participated in this study following recruitment from a university. Upon completion of the informed consent process, participants completed the m-CTSIB balance test and the GAD-7 anxiety questionnaire. The m-CTSIB balance test involved 4 different sensory integration trials. Each trial lasted for 30 seconds. The scoring for each assessment was as follows: for the m-CTSIB, only the composite sway score was recorded. A higher sway score is indicative of lower control over balance. For the GAD-7 assessment, the total score (0-21) was recorded. No weight was given to the difficulty of the problems, as this assessment was only used to show prevalence or no prevalence of anxiety feelings.

The Generalized Anxiety Disorder 7-Item (GAD-7)

The GAD-7 is a self-administered patient questionnaire used as a screening tool and severity measure for generalized anxiety disorder.⁵ The GAD-7 contains seven items used to measure the severity of symptoms over the last 2 weeks using reported response categories of (0) "not at all," (1) "several days," (2) "more than half the days," and (3) "nearly every day." Assessment of the disorder is indicated by the sum of the scores from all seven items, with a total score

ranging from 0 to 21. For this study, the GAD-7 will not be used as a formal assessment or diagnosis for anxiety. The GAD-7 cannot be administered without supervision by a licensed therapist. Therefore, Dr. Kelly Gibas, LPCC, CFMP supervised the assessment. If needed, counseling was offered in the Health Services department as well as a consultation with Dr. Gibas.

BioSway

Researchers will be assessing balance scores using the Biodex BioSway. Each subject will be advised of the expectations, procedure and purpose of attaining BioSway data. Participants will be barefoot throughout the whole study. Participants will complete a m-CTSIB on the BioSway machine. The test provides a generalized assessment of how well an individual can integrate various senses with respect to balance, and compensate when one or more of those senses are compromised.⁶ The BioSway will be calibrated at the start of every day in which participants will be assessed. The test procedure will be broken into four trials:

- Trial 1: eyes open, firm surface
- Trial 2: eyes closed, firm surface
- Trial 3: eyes open, unstable surface (foam pad)
- Trial 4: eyes closed, unstable surface (foam pad)

Each trial will last 30 seconds while the participant's balance is assessed. A higher sway index indicates a reduction in the participant's ability to remain steady during the test. These quantitative results will be used for data analysis.

Inclusion criteria

- Had to be between the ages of 18 and 25 years
- Could be male or female
- Had to be currently participating in a collegiate sport, in season or out of season
- Had to complete the Informed Consent
- Had to complete GAD-7 and Burns Anxiety Inventory
- Had to receive clearance for exercise testing based on *Exercise Preparticipation Health Screening Questionnaire for Exercise Professionals* (adapted from ACSM's *Guidelines for Exercise Testing and Prescription*)
- Had to be able to attend one appointment lasting approximately one hour

Exclusion criteria

- Any individual who did not submit to the informed consent
- Any individual under the age of 18 was not allowed to participate in this study, as they do not meet the specified inclusion age range and add no additional benefits to the research purpose
- Any individual with a diagnosed vestibular disease or metabolic condition
- Any individual who failed to fill out the required health history form.
- Any individual deemed high risk (one or more symptoms or a diagnosed condition) according to the *Exercise Preparticipation*

Health Screening Questionnaire for Exercise Professionals and who doesn't obtain signed clearance documentation from a licensed physician

- Any individual who had a current, diagnosed TBI, or had one in the last 12 months
- Any individual who had a lower extremity injury in the last 12 months
- Any individual who had four or more diagnosed TBI's

Results

A total of 16 athletes were tested for this study. 10 athletes were categorized as a contact sport athlete, and 6 were categorized as a noncontact sport athlete. The researchers used SPSS to run a paired samples t-test. Based on the results of this test, there was a significant ($p=0.05$) difference between contact and noncontact sports and their m-CTSIB ($p=.001$). There was no significant difference ($p=0.05$) between sport grouping and GAD-7 scores ($p=.113$). Figure 1, represents the comparison of contact and noncontact sporting groups, and their average sway index scores.

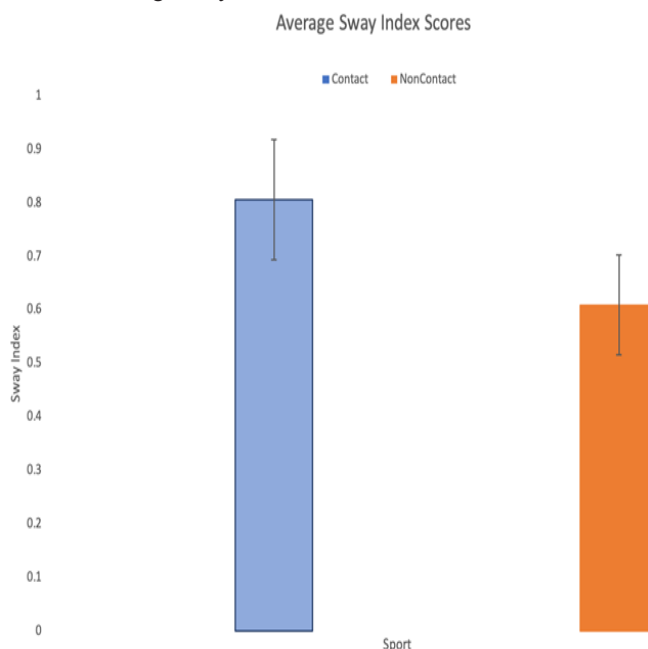


Figure 1 Bar graph depicting average values for sway index within participant groupings. Contact sport standard deviation is 0.11 and noncontact is 0.09.

Discussion

Based on the statistical analysis run on the data from this study, there was a significant difference between contact and noncontact sport athletes and their m-CTSIB scores. There was no significant difference between sport grouping and GAD-7 scores. These conclusions suggest that contact sport athletes may experience subconcussive trauma more frequently than noncontact sport athletes.⁷ Due to the subconcussive trauma that these contact sport athletes experience, their ability to balance is impeded and/or dissipated. This could point to a known connection between head trauma and brain function, namely the brain's control over balance, posture, and coordination. These aspects of body control are located throughout many lobes of the brain. Balance requires the integration of sensory information with motor control and cerebellar control. The widespread control of balance

leaves much room for injury to affect the brain's ability to control balance. The lack of significance between sport grouping and GAD-7 scores indicate that subconcussive and concussive trauma may affect the brain differently in terms of anxiety. Furthermore, anxiety can be difficult to study as much of it is perceived and varies from individual to individual. Altogether, these findings indicate the importance of using balance ability to test trauma in contact sport athletes, which is supported by other previous research.^{7,8}

Conclusion

As seen in Figure 1, there was a higher average sway index in athletes involved in contact sports than those playing noncontact sport. This would lead the researchers to find a connection between head contact and possible trauma leading to an inability to maintain balance. Future research in this area should aim at increasing participant size of both contact and noncontact groups. Increasing participant numbers could potentially provide a greater insight into relationships between collision sports and subconcussive injury as shown across a broader range of individuals. In turn, sports medicine may better understand the relationships between sports and injury. As more knowledge is gained in the realm of head injuries and balance and anxiety following injury, clinicians can better treat the injuries of the athletes, allowing for an increase in sports performance while also limiting the negative long term side-effects of TBI.

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Conflicts of interest

None declared.

References

1. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: Summary and recommendations for injury prevention initiatives. *J Athl Train.* 2007;42(2):311–319.
2. Perez OH, Green RE, Mochizuki G. Characterization of balance control after moderate to severe traumatic brain injury: A longitudinal recovery study. *Phys Ther.* 2018;98(9):786–795.
3. Yang J, Peek-Asa C, Covassin T, et al. Post-Concussion Symptoms of Depression and Anxiety in Division I Collegiate Athletes. *Dev Neuropsychol.* 2015;40(1):18–23.
4. Wright AD, Smirl JD, Bryk K, et al. Cerebral autoregulation is disrupted following a season of contact sports participation. *Frontiers in Neurology.* 2018;9.
5. Jordan P, Shedden-Mora MC, Löwe B. Psychometric analysis of the Generalized Anxiety Disorder scale (GAD-7) in primary care using modern item response theory. *PLoS one.* 2016;12(8).
6. Freeman L, Gera G, Horak F, et al. Instrumented test of sensory integration for balance: A Validation Study. *J Geriatr Phys Ther.* 2018;41(2):77–84.
7. Jesse Mez, Daneshvar DH, Kiernan PT, et al. Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football. *JAMA.* 2017;318(4):360-370.
8. Sussman ES, Ho AL, Pendharkar AV, et al. Clinical evaluation of concussion: The evolving role of oculomotor assessments. *Neurosurg Focus.* 2016;40(4).