# Novel Protocol for Observational Research on Cranial Strain Patterns and Concussions

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## Abstract

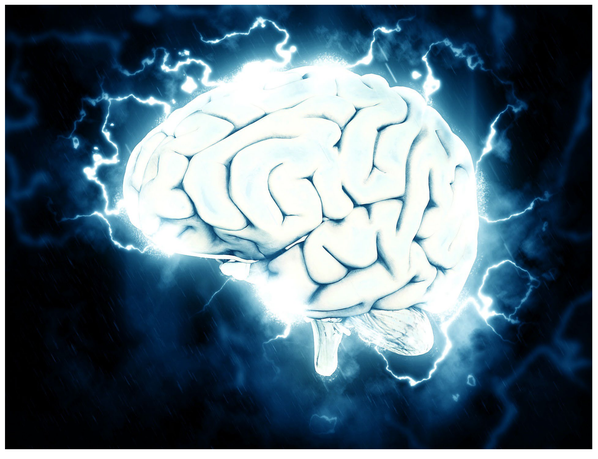
**Background:**
Concussions are a common injury in athletes and cause a wide array of cognitive and behavioral dysfunctions. Due to the nature of concussions, cranial somatic dysfunctions may be commonly seen in these patients.

**Purpose:**
This study is researching the hypothesis that pathologic cranial strain patterns are more common in concussed athletes when compared to their baseline evaluation. Second, research question is that pathologic cranial strain patterns impact neuropsychological testing (IMPACT), BESS and VOMS more significantly than physiologic cranial strain patterns.

**Study Design:** Observational

**Methods:**
College athletes with no prior concussions or head injuries will be recruited and evaluated at the beginning of the individual sports season for baseline cranial strain patterns, neuropsychological testing (IMPACT), VOMS, and BESS. Athletes who experience a concussion during the year will be reassessed weekly until concussion has resolved. The results of these evaluations and testing will be used to compare the statistical significance of cranial strain pattern correlation to the impact on balance and vestibular ocular motion, neuropsychological testing (IMPACT), in both unconcussed and concussed collegiate athletes. IRB Pending.

**Clinical Relevance:**
By determining the impact that cranial somatic dysfunctions have on balances and vestibular ocular motion, it can lead to further randomized control studies and development of additional treatment protocols on how osteopathic manipulative medicine (OMM) treatment may positively impact concussion recovery in both severity and longevity.



## Introduction

**Overview**: Concussions are the cause of 5-9% of all sports-related injuries each year.[4] Many athletes can sustain multiple concussions in a single year and can have symptomatology that is long lasting. While evaluation of concussions are extensive to rule out life threatening injuries, the osteopathic approach to concussions is lacking. Osteopathic evaluation, specifically cranial evaluation may lead to expansion of treatment of concussions.

**Current Evaluation:** Concussion evaluation is typically done initially by a sideline examiner and then further in a hospital to rule out life threatening injuries. Sports concussion assessment tool 5 (SCAT5) is commonly use to diagnose a concussion sideline.[1] Other useful test include vestibular/ocular-motor screening (VOMS),[1] which uses eye and head movement to provoke symptoms of a concussion and the balance error scoring system (BESS), which is used to evaluate balance problems and is the most widely used postconcussion balance test.[2]

**Potential Evaluation**: The current evaluation protocol for diagnosing concussions is well rounded and accurate but fails to account for the osteopathic approach. In addition to adding an osteopathic evaluation, adding a cranial evaluation can lead to further diagnoses that if treated might help treat the symptomatology of concussions and allow quicker recovery for athletes.

**Research Aims:** The goal of this study is to observe the cranial strain patterns of athletes with and without concussions and to determine if certain cranial strain patterns have more of an effect on neuropsychological testing, BESS, and VOMS.

## Methods

College athletes with no prior concussions or head injuries will be recruited and evaluated at the beginning of the individual sport season. Athletes must be diagnosed with a concussion by a family medicine physician of neurologist and should have no previous diagnosis of a concussion, neurodegenerative condition, spinal cord injury, or seizure. Baseline neuropsychologic testing (IMPACT), VOMS, and BESS will be recorded as well as cranial strain patterns will be evaluated. Athletes who experience a concussion within their sport season will be reevaluated for IMPACT, VOMS, and BESS, and cranial strain pattern. Athletes will continue reevaluated weekly, ideally on the same day and time, until concussion has resolved. At the end of the season athletes who did not sustain a concussion will be reevaluated for end of season IMPACT, VOMS, BESS, and cranial strain patterns. The results of these evaluations and testing will be used first to see if pathologic cranial strain patterns are more common in concussed athletes. The results will also be used to compare the statistical significance of cranial strain pattern correlation to the impact on balance and vestibular ocular motion, and neuropsychological testing, in both unconcussed and concussed collegiate athletes. These calculations will be done using a paired samples t-test to look at BESS and VOMS testing on their own, as well as a multivariate analysis to see if BESS and VOMS together are reflective of a single cranial strain.
This study is modeled from a study performed at the New York Institute of Technology College of Osteopathic Medicine.[3]

## Next Steps

There are multiple next steps to take. First is to recruit a 2023-2024 OPP scholar to help collect data. Second is submit for IRB approval and make the necessary changes to move further with the study. Lastly, we need to recruit athletes to follow throughout the course of their sport season. The hope is this study will be completed by the end of the 2024 school year, depending on the amount of data collected. If there is not an adequate amount of data further recruiting will need to occur to collect data during the next school year.

**Limitations:** There are a couple of limitation involved in completing this study. First is time. The protocol and literature research has taken almost a year to complete and with the end of my scholar year, the study will have to recruit more individuals to help gather data on my behalf. Second is the number of concussions that occur within a given sport season. While concussions are a common sports related injury, the study depends on a collegiate athlete that has no prior concussions to get a concussion. This limits the number of athletes that fall within the inclusion protocol, further limiting the number of concussions that occur within a single season.

**Future Studies:** This study and the outcomes can lead to further studies on cranial somatic dysfunctions impact on concussion. In researching this correlation, further studies can begin to target cranial treatments and the correlation of concussion symptomatology and recovery time.

## References

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