



# The Effect of Concussion History on Lower Extremity Musculoskeletal Injury in Collegiate Athletes: A Critically Appraised Topic

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## CLINICAL SCENARIO

- Concussions can cause a multitude of both acute and chronic symptoms including headache, blurred vision, dizziness, nausea, double vision, memory loss, balance problems, cognitive and neurological dysfunction.<sup>1</sup>
- The majority of athletes who sustain a concussion experience documented recovery from self-reported symptoms, neurocognitive impairments, and balance dysfunction within 7-10 days post-injury.<sup>2</sup> However, there is evidence to suggest that measurable neuromuscular deficits remain in athletes beyond clinical recovery of a concussion and exceed return to play criteria fulfillment.<sup>1,5</sup>
- Deficiencies in neuromuscular control has been associated with musculoskeletal injury, but limited research has explored whether neuromuscular control insufficiencies secondary to concussion are correlated with risk of orthopedic injury.<sup>3</sup>

## FOCUSED CLINICAL QUESTION

Are collegiate athletes with a history of concussion at a higher risk of sustaining a lower extremity injury than collegiate athletes without a history of concussion?

## SEARCH STRATEGY

**Sources of Evidence Searched**  
Literature search was conducted in September 2019. Data sources searched included EBSCO Host ProQuest, SAGE Journals, SPORTDiscuss, and Sacred Heart University Library. **Search terms:** (concussion) AND (lower extremity injury) AND (athletes). Studies were limited to academic and peer reviewed articles published in English after 2009.

**Study Selection**  
Criteria for selection required that original studies: a) included information from participants for history of concussion as well as history of lower extremity injuries, b) determined the relationship between history of concussions and risk of lower extremity injuries in athletes, c) investigate collegiate athletes, d) were not meta-analysis or literature reviews, e) Were level 3 evidence or higher.

## SUMMARY OF SEARCH, "BEST EVIDENCE" APPRAISED, AND KEY FINDINGS

**Summary of Search and Best Evidence Appraised**

- The search of the literature produced 12 articles relating to all search terms and search parameters.
- After review, four relevant studies met the inclusion criteria and were included.<sup>1-4</sup>
- All studies were critically appraised using the STROBE criteria.

**Key Findings**

- The odds of sustaining a lower extremity musculoskeletal injury were higher in athletes with a history of concussion.<sup>1-4</sup>
- Common injuries include ankle sprains, knee sprains, and lower extremity muscle sprains.<sup>1-4</sup>
- Athletes with a history of multiple concussions had greater odds of reporting knee injuries compared to controls.<sup>4</sup>
- There is inconsistent evidence regarding the correlation of history of concussion and lower extremity injury when comparing by sex. Houston et al.<sup>4</sup> concluded that females with a history of concussion had greater odds of reporting an ankle sprain or knee injury than males with a history of concussion, while Herman et al.<sup>3</sup> found no significant difference between lower extremity injury between males and females with a history of concussion.

## RESULTS OF SEARCH

**Table 1. Summary of Study Designs of Articles Reviewed.**

Author	Study Design	Level of Evidence*	STROBE Score
Brooks et al., <sup>1</sup>	Cohort Study	3	19/22
Gilbert et al., <sup>2</sup>	Cross Sectional	3	20/22
Herman et al. <sup>3</sup>	Observational Cohort Study	3	20/22
Houston et al., <sup>4</sup>	Cross Sectional	3	20/22

\*Level of evidence assessed using the Oxford Centre for Evidence-Based Medicine 2011 criteria.

## CLINICAL BOTTOM LINE

There is consistent good quality evidence to support that collegiate athletes with a history of concussion are at an increased risk for sustaining a lower extremity musculoskeletal injury.

**Strength of Recommendation**  
Based on the consistent findings from level 3 evidence, a grade B strength of recommendation was made based on the Strength of Recommendation Taxonomy (SORT).

## IMPLICATIONS FOR PRACTICE, EDUCATION, AND FUTURE RESEARCH

- The results of this appraisal support the answer of the focused clinical question by identifying that having a history of concussion is correlated with an athlete's increased risk of sustaining a lower extremity musculoskeletal injury. While the findings support a correlation between concussion history and rate of lower extremity injury, no causation was identified in the studies reviewed. It is possible that the increased injury rate is secondary to deficits in neuromuscular control, as they can persist beyond the standard recovery time and completion of standard concussion return-to-play protocols.<sup>5</sup>
- Previous literature has explored deficits in gait and neuromuscular control in patients with a history of concussion, but it is still unclear if those deficits are directly related to the increased risk of lower extremity injury.<sup>5,6</sup>
- Future research is necessary to determine the cause of the relationship between history of concussion and increased risk of lower extremity injury in order to assist clinicians in best managing an athlete's return to play post concussion.

## REFERENCES

1. Brooks MA, Peterson K, Biese K, Sanfilippo J, Heiderscheid BC, Bell DR. Concussion increases odds of sustaining a lower extremity musculoskeletal injury after return to play among collegiate athletes. *Am J Sports Med.* 2016;44(3):742-747.
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