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Risk Factors for Concussion in Collegiate NCAA Division II Men's and Women's Soccer Athletes

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ABSTRACT

Background: Certain risk factors may predispose athletes to an increased risk of concussion.

Purpose: To identify risk factors for concussion among men's and women's college soccer athletes.

Methods: A short electronic survey was sent out to NCAA Division II universities in Ohio. Participants were women's and men's soccer athletes participating in either varsity or junior varsity soccer at their respective universities.

Results: Of concussions sustained while playing soccer, 29.4% of female participants sustained a concussion compared to only 17.4% of male participants. Concussions occurred during a competitive match in 8 of the 9 concussions compared to practice. There were 2.8 concussions per 100 years for strikers as well as midfielders, while no concussions occurred while playing defender. Varsity athletes showed a high incidence of concussions (33.3%) compared to JV/Reserve athletes in which there were no concussions ($p = 0.018$). Among players with a concussion history, 5 of the 12 (41.7%) sustained multiple concussions. The most common MOI was contact with another player's body (36.8%). There were only 3 players who wore mouthguards, and 1 who wore headgear with no significant difference between protective equipment worn and diagnosis of concussion ($p = .157$)

Conclusions: Being a varsity athlete, playing in a game, having a previous history of concussion, and playing as a striker or midfielder were all risk factors for concussion.

INTRODUCTION

Head injuries and concussions in soccer have been the focus of a large amount of attention in recent years. Much research has been done gathering information about signs and symptoms, evaluation, and long-term sequelae. Because of the increasing awareness of concussions there is a large discussion concerning head injuries and whether or not rule or equipment changes should be made to protect the safety of athletes involved in soccer.

Research has shown that in recent years the incidence of concussion has been increasing significantly (Rosenthal et al., 2014; Lincoln et al., 2011). In a study done on high school soccer injuries, researchers found that concussion accounted for 10.8% of all injuries sustained (Yard et al., 2008).

Over the years, there have been many different definitions of concussion, which has led to an inability to compare research. More recently though, there has been a push to come up with a definition of concussion that can be used by everyone. In November 2012 the Fourth International Conference on Concussion in Sport was held in Zurich Switzerland. They defined concussion as "a complex pathophysiological process affecting the brain, induce by biomechanical forces" (McCroory et al., 2013). They also noted that concussion usually involves "a rapid onset of short-lived impairment of neurologic function that resolves spontaneously" (McCroory et al., 2013). In some cases symptoms may take more time to appear (McCroory et al., 2013). These symptoms can be classified in three categories: somatic, neuropsychological, and cognitive (Pflund et al., 2003).

Not only are short-term symptoms of concussion a concern, but the long-term effects caused by repetitive concussions is also a great worry. Which is why continued research needs to be done to figure out whether concussion can specifically lead to certain conditions. One study by Kerr et al. (2012) noted that the risk of being diagnosed with depression increased with an increasing amount of self-reported concussions.

There are many steps we can take as parents, coaches, and health care professionals to help prevent injuries and safely return athletes participating in sports. One way to help properly manage concussions (Bramley et al., 2012) is to educate athletes, parents, and coaches about how they occur, and what signs and symptoms they are characterized by. In one study the authors noted that 72% of soccer players who had received concussion education said they would always notify their coach of concussion symptoms, compared to only 36% of players who reported not receiving any concussion education (Bramley et al., 2012).

PURPOSE

The purpose of this study was to identify risk factors for concussion among men's and women's college soccer athletes, and determine the likelihood of recurrent or a new concussion based on those risk factors.

METHODS

An online survey using Qualtrics was sent out to collegiate division II men's and women's soccer programs in Ohio. Participants included both junior varsity (JV) and varsity players. The survey consisted of initial questions regarding demographics, position, and use of protective equipment. Following this section there was a filter question asking whether the athlete had sustained a concussion, and specific questions regarding the details of the concussion for athletes who had sustained at least one. Before participating in the study, all subjects read and indicated their consent by clicking on the link to access the survey. The informed consent statement was approved by the University's Institutional Review Board for the Protection of Human Subjects, which also approved the study.

One week following the original email, a follow-up email was sent out to remind potential participants of the survey and encourage an increased response rate. Inclusion criteria was collegiate JV and varsity men's and women's soccer players that were over the age of 18, division II colleges, and colleges in Ohio. Exclusion criteria were athletes under the age of 18 or athletes not participating in collegiate men's or women's soccer. All information gathered was completely anonymous.

STATISTICAL ANALYSIS

Data was analyzed using SPSS software, and a priori level of significance (alpha level) of $>.05$ was set. We used a chi-square as well as Fisher's Exact Test to compute the statistical significance of certain risk factors, and determine the likelihood of concussion from the results. The statistics were also sorted for common themes, and descriptive statistics were used to indicate some of the results.

RESULTS

Demographics

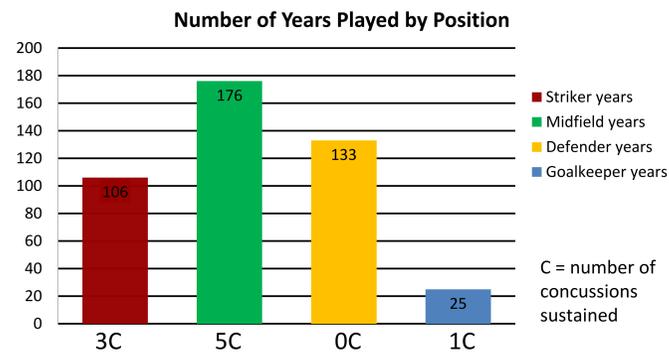
In this study there were a total of 40 participants, 23 females and 17 males. There were 27 varsity athletes and 13 JV athletes and 33 of the 40 participants had played more than 10 years of competitive soccer. Of the 40 participants in the study, 14 (35%) thought they had sustained a concussion that had gone undiagnosed, which was significant ($p = 0.002$; Fisher's $= 0.004$). Finally, 12 of the 40 participants in this study (30%) were fearful of sustaining a concussion, whether for the first time or a recurrent concussion.

Gender

Results showed that of those who sustained concussions while playing soccer, women were 12% more likely to sustain a concussion with 29.4% of female participants sustaining a concussion compared to only 17.4% male participants. However there was no significant difference between concussions sustained while playing soccer and gender ($p = 0.368$).

Match v. Practice

Of the 9 concussions sustained while playing soccer 8 (89%) occurred during a competitive match, compared to during a practice.



Varsity v. Junior Varsity

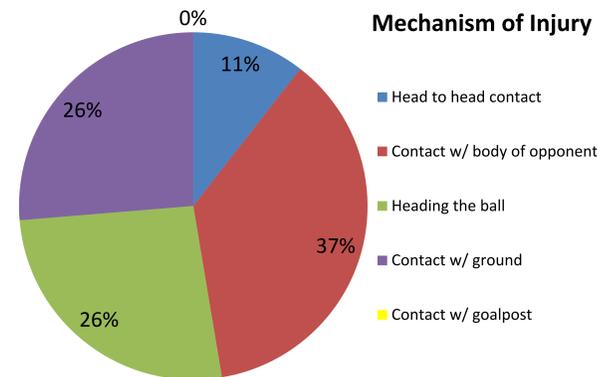
Varsity athletes showed a high incidence of concussions (33.3%) compared to JV/Reserve athletes in which there were no concussions while playing soccer. There was a significant difference between JV and varsity athletes for concussions sustained ($p = 0.018$).

Previous Concussion History

Among players with a concussion history, 5 of the 12 (41.7%) sustained multiple concussions. One athlete sustained a total of seven concussions in a time period of nine years. There was a total of 23 concussions sustained from the 12 participants who indicated they had a history of concussion, 19 of them occurring while playing soccer.

Protective Equipment

Of the 40 respondents, there were only 3 players who wore mouthguards, and 1 who wore headgear. However, of the 9 athletes who sustained a concussion while playing soccer, 2 of them were wearing headgear at the time of the concussion. There was no significant difference between protective equipment worn and a diagnosis of concussion ($p = .157$)



DISCUSSION

Gender

In agreement with most of the current research on the topic, concussions were seen to be more common in females compared to males. (Rosenthal et al., 2014; Delaney et al., 2008; Castle et al., 2012; Covassin et al., 2003; Fuller et al., 2005) This could be due to neck strength differences in males and females or simple a difference in body size or ball to head size ration. (Covassin et al., 2003)

Match vs. Practice

This study also found that concussions were 8 times as likely to occur during a match compared to practice. These results agree with all of the research done in this area up to this point. (Yard et al., 2008; Covassin et al., 2003) Due to the more intense nature of a match compared to practice, this risk factor naturally seems quite obvious, but unavoidable. In a game, there is no holding back, especially when the individual you are trying to win the header from is an opponent, not your teammate. Recently, there has been a lot of talk about changing the rules regarding heading, especially in the younger population. As of November 2015, US Soccer announced that heading would be eliminated in children 10 and under, and that heading in practice would be limited for children ages 11-13. This regulation only applies currently to U.S. Soccer's Youth National Teams and Development Academy, but they have strongly advised that they be followed in youth soccer in general. (U.S. Soccer, 2015)

Position

There have been a few articles that sought to inquire as to what position in soccer was identified with the highest incidence of concussion. (Delaney et al., 2008; Boden et al., 1998) However, most did not contain enough participants to conclude which position was at greatest risk. In the present study midfielders and strikers were at increased risk of concussion while defenders were at a decreased risk. Goalkeepers did not have enough data to calculate approximate risk. It is possibly that midfielders and strikers are at more risk because often times they are going for an offensive header, with their back towards the opposing defender. Therefore they may not be able to react protectively to a defender that is going up for a header behind them.

Varsity vs. Junior Varsity

As shown in the study varsity athletes showed a statistically significant difference in number of concussions sustained (33.3%) compared to JV/Reserve athletes (0%). In all the literature we looked at, there was no mention of playing level (varsity vs. JV) in college athletes as a risk factor for concussion. However, the results make sense for several reasons. First of all, varsity athletes play in many more games during their careers, and participate in more practices. Simple an increased volume of time spent playing soccer would give varsity athletes a greater likelihood of sustaining a concussion. Moreover, varsity games are usually more intense matches that affect the rest of the season, they're games are "higher profile," and viewed by significantly more fans, giving the game a more intense nature.

Previous Concussion History

This study agreed with previous research in the area, indicating that a previous history of concussion increased the likelihood of recurrent concussion. (Delaney et al., 2008; Zemper, 2003) Participants had a 41.7% (5 of the 12 participants) chance of sustaining a recurrent concussion after they had their first, while only 30% of the total sample in this study sustained a concussion. One study by Zemper et al. (2003) noted that football players were 5.8 times more likely to sustain a concussion if they had sustained a previous concussion within the previous five years.

Mechanism of Injury

As in this study, the most common scenario for concussion is collision with another player. (Boden et al., 1998; Barnes et al., 1998; Agel et al., 2007) A general argument on this topic involves the incidence of concussions sustained from simply heading the ball. (Yard et al., 2008; Boden et al., 1998; Barnes et al., 1998) However, in most studies that show heading the ball to be a MOI for concussion, most do not specify whether the concussion was sustained from simply heading the ball, or occurred while going up for a header, and coming into contact with another player's body or head. This study showed that heading the ball was the second most common MOI. The majority of concussions resulted from a mechanism related to heading the ball, whether it was contact with another players head, body, or the ball. Soccer players should be cognizant of this fact, and make sure to maintain proper technique going straight up for a header so that they can protect themselves as best as possible from a possible concussion.

Protective Equipment

It is interesting to note that 2 of the 9 athletes who sustained concussions while playing soccer in this study were wearing headgear at the time of their concussion, while only one player indicated they currently wore headgear. Though this is a inconsistency in the results, it still seems to indicate that headgear does not seem to be beneficial in preventing concussions. Because there were only 3 players who wore mouthguards, and 1 who wore headgear in this study, results are somewhat inconclusive. In one study regarding headgear use, the researchers found that of soccer athletes who wore headgear only 26.9% suffered a concussion, while 52.8% of athletes suffered a concussion who did not use headgear. (Delaney et al., 2008) Also of interest is the fact that this research found that players with a past history of concussion were more likely to wear headgear, possibly indicating an even higher benefit of headgear use than the statistics indicated. (Delaney et al., 2008) Mouthguard use in soccer players was not shown to be a statistically significant risk factor for concussion, though it definitely did not prevent concussion, and there was a trend toward increased likelihood of suffering a concussion with use of a mouthguard. (Delaney et al., 2008; Delaney et al., 2002)

CONCLUSION

In the end, this study helps to identify specific concussion risk factors among men's and women's college soccer athletes, and determine the likelihood of recurrent or a new concussion based on those risk factors. Clinically, this provides data to help inform return to play guidelines based on risk factors for concussion. Future research should be aimed at determining whether position is a risk factor for concussion based on the number of exposures at that position. In summary, the most dangerous place to be as a soccer player is playing as a varsity athlete in a competitive match as a striker or midfielder going up to head the ball.