



**CANADIAN ACADEMY OF SPORT MEDICINE
ACADÉMIE CANADIENNE DE MÉDECINE DU
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DISCUSSION PAPER

Head Injuries and Concussions in Soccer

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1.0 INTRODUCTION

Soccer has not always been perceived as a high risk sport for head injuries or concussions.^{1,2,3,4,5} However, recent research suggests that soccer players have head injury and concussion rates similar to football and ice hockey.^{5,6,7, 8, 9, 10, 11,12, 13,14,15,16,17,18,19} The Canadian Academy of Sport Medicine (CASM) has undertaken this discussion paper to review the literature and to provide recommendations to the public to decrease the risk of head injuries and concussions in the sport of soccer.

2.0 DEFINITIONS

Head Injury – a traumatic injury to the head which is usually evident on clinical examination. It is usually characterized by ecchymoses, hematoma, lacerations, deformities, or cerebral spinal fluid leakage.¹ A head injury may constitute a minor diagnosis, such as a scalp laceration, or it may comprise a more serious diagnosis such as a concussion or a skull fracture.

Concussion – a form of head injury characterized by any alteration in cerebral function and caused by a direct or indirect (rotation) force transmitted to the head. It results in one or more of the following acute signs or symptoms: a brief loss of consciousness, light-headedness, vertigo, cognitive and memory dysfunction, tinnitus, blurred vision, difficulty concentrating, amnesia, headache, nausea, vomiting, photophobia or a balance disturbance. Delayed signs and symptoms may also include sleep irregularities, fatigue, personality changes, inability to perform usual daily activities, depression or lethargy.^{2,3,4}

3.0 RECOMMENDATIONS

3.1 Soccer should be regarded as a contact sport in which players are at risk for head injuries and concussions.

Studies have shown that almost half of varsity level university soccer players may experience symptoms from a concussion during just one fall season,⁵ and almost two thirds of these players may experience symptoms from a concussion over one full year of soccer participation.⁶ When comparing different sports, research has shown that soccer has head injury and concussion rates similar to football and ice hockey.^{5,6,7,8,9,10,11,12,13,14,15,16,17,18,19} These injury rates are comparable, not only for elite athletes participating in soccer, football and ice hockey, but also for recreational and community athletes participating in these sports.²⁰

3.2 Safe play and respect for one's opponent should be emphasized.

Concussions during participation in soccer are caused most frequently by collisions and contact among players.⁸ The rules of soccer do not allow any player to engage in play which might endanger the safety of another player,²¹ and referees should continue to ensure that reckless and potentially harmful actions to others are not permitted during the game. The spirit of fair play and respect for one's opponent should be emphasized by parents, coaches and referees.

3.3 Players, parents and coaches should be aware of the signs and symptoms of a concussion.

Research has revealed that the majority of sport related concussions may go unrecognized.^{5,6,22,23} The need to identify an acute concussion and prevent a player from returning to competition is vital because this may prevent a more severe concussion or life threatening complications if a player receives another blow to the head while still suffering symptoms of a concussion.^{23,24,25,26,27,28,29,,30,31,32} It is also important to accurately diagnose a concussion because multiple concussions may result in longer and more severe episodes of functional disability.^{12,33} Repeated concussions may also result in progressive and cumulative neurologic and neuropsychologic impairment.^{16,34,35}

In an effort to provide a safer environment for athletes, it is important that players, parents and coaches be reminded of the common signs and symptoms of a concussion (see definition above). The need to err on the side of caution when diagnosing a concussion should be emphasized (“When in doubt, sit them out!”).³⁶

3.4 All concussed athletes should be examined and treated by a medical doctor familiar with diagnosis and treatment of sport related concussions.

When diagnosing and deciding disposition for a concussed athlete, concussion guidelines such as those by the CASM Concussion Committee and the Vienna Concussion in Sport Group, can help guide return to play decisions.^{2,36} Parents, players, coaches and health care providers should be reminded of the critical points of the guidelines:

- a. Players who show any signs and symptoms of a concussion should not be allowed to return to play in the current game or practice.
- b. Concussed players should not be left alone during the immediate period following a concussion. Close monitoring for deterioration is essential in the initial post-concussion period and should continue at least until the player's symptoms have stabilized.
- c. The concussed athlete should be evaluated by a medical doctor with knowledge and experience in concussion management.
- d. Return to play must follow a gradual process. It must be monitored by a medical doctor with knowledge and experience in concussion management.

3.5 Use only soccer balls which are age/size appropriate, in good condition, and inflated appropriately.

Just as all parents and players would insist on proper sized protective equipment and athletic gear, it should be remembered that soccer balls also come in different sizes. Using different size balls is intended to prevent injury and make the balls more manageable for different size players. The smaller balls are lighter and easier for children to manipulate. The smallest size (No. 3) is used for children under 10 years of age, the medium sized ball (No. 4) is used for juniors (10 to 14 years of age), and the largest ball (No. 5) is used for athletes over 14 years of age.^{18,37,38}

Soccer balls should be checked frequently for proper inflation pressures. The pressure inside a ball may change over time because of frequent use or because of changes in temperature and weather conditions. The recommended inflation pressure is usually found on the ball. Hyperinflation of soccer balls has been proposed as a possible risk factor for headaches and possibly concussions in soccer players.^{7,39,40}

Most modern soccer balls are made from synthetic materials which are water resistant.¹⁰ Older balls made of leather or newer synthetic balls with cracks in the material should not be used in wet conditions as the weight of a wet ball may increase by 20% or more and increase the amount of force absorbed by the cranium during heading.^{18,41}

3.6 Children should minimize heading the ball until there is a better understanding of the immediate and possible long-term effects of heading and until they sufficiently master the proper heading techniques.

Due to children's immature anatomy and inexperience, many believe that children may be more at risk for head and brain injuries than adults.^{19, 40,42} Compared to adults, children have proportionately larger heads but thinner skulls to protect the brain.⁹ Younger soccer players also have weaker neck muscles which, when developed, may help to absorb and dissipate the forces applied to the head.^{2,3, 10, 16,18,43,44,45} Children may also be less adept at the techniques of heading a ball, which, when performed properly, may decrease the amount of energy transmitted to the brain.^{13,16}

Whether heading is a significant mechanism of injury leading to concussions is less controversial now than it once was. Studies addressing mechanism of injuries showed that the ball was involved in less than 25% of all cases of concussions and few, if any, concussions occurred during uninterrupted purposeful heading.^{8, 10, 37} Other studies showed that neither the average number of headings per game, nor considering oneself to be someone who heads the ball frequently, was a significant risk factor for concussions.^{5,6} While there is less fear that heading the ball causes a significant number of concussions, the question of possible long-term effects of heading remains controversial. European studies showed neuropsychological and neuroanatomic changes in active and retired soccer players when compared to controls.^{12,14,16,17} North American studies tended not to show these deleterious effects.^{46,47}

Suggestions for dealing with heading include outlawing heading in young age groups, limiting its use in young age groups or continuing with no special precautions as in the past.^{10,39} Until long-term risks of heading soccer balls are more clearly elucidated, it is prudent to limit the amount of heading that young children perform, at least until an age when they begin to master the heading techniques and their neck and skull anatomy are more mature.⁴²

3.7 Proper heading techniques should be taught in a supervised and controlled setting.

It is well accepted that when proper methods of heading a soccer ball are used, these techniques may decrease the amount of force transmitted to the brain.^{10,17} These techniques should be taught by a qualified individual with good knowledge of different methods of heading a soccer ball in order to lessen the force applied to the cranium during heading.^{13,39,42} This is especially important when children first learn to head the soccer ball. Some experts suggest using a specially designed lightweight ball or small ball suspended from a rope (“piñata model”) to initially illustrate proper body positioning and contact points.³⁸ Neck musculature strengthening should also be emphasized because strong neck muscles may help dissipate the energy applied to the head after contact with the soccer ball.^{6,10,15,40,41}

3.8 Goalposts should be appropriately padded and anchored to the ground.

Incidents with goalposts have resulted in many serious head injuries and even several deaths. In the past few decades, most fatalities from soccer-related injuries have come from traumatic contact with goalposts.^{42,48,49} Portable goalposts need to be anchored in a secure and approved fashion as death or serious head and neck injury can easily occur from goalposts that fall forward onto an unsuspecting child or adolescent.⁵⁰ In the event of contact with goalposts, portable and permanently installed posts should have adequate padding to reduce injuries. Preliminary data has shown that padding goalposts has decreased the number of injuries from contact with goalposts.⁵¹

While different shapes are permitted for goalposts, further research is required to validate the common belief that round or elliptical shaped goalposts are safer than square or rectangular shaped goalposts.

3.9 Goalkeeper is the position most at risk for concussion and these players should be protected accordingly.

Numerous studies have shown that goalkeepers are the players most at risk for concussion.^{5, 6,52,53,54} The role of a goalkeeper is unique. They are expected to stop balls, often kicked from a short distance. These balls can travel at speeds in excess of 120 km/hr.¹⁶ They are also vulnerable to being kicked, kneed or elbowed in the head as players converge on the goal, or as they cover up a ball at or near ground level. Players, coaches and referees should be aware of the vulnerable situations in which goalies are placed. Respect for their safety should be emphasized and the rules that protect them should be strictly enforced at all times. Due to their increased risk of concussions, goalies may be the position most likely to eventually benefit from a proven and effective form of headgear.

3.10 Mouth guards should be worn during participation in soccer.

Current evidence that mouth guards prevent sport related concussions is poor. While a few studies suggested a possible benefit,^{55,56,57,58} others failed to show any benefit.^{6,59,60} While the effectiveness of mouth guards in preventing concussions is controversial, the effectiveness in preventing orofacial and mandibular injuries is not.^{59,61,62,63} Wearing a mouth guard is a proven and reliable way to prevent orofacial and mandibular injuries. The proper use of well-made mouth guards should be recommended for its proven role in preventing orofacial and mandibular injuries and for its possible, if yet unproven, benefit of preventing concussions.

3.11 The use of protective headgear in soccer needs to be studied further before widespread use can be recommended.

The use of protective headgear has been suggested by some as a possible means of decreasing the number of head injuries and concussions in soccer.^{9,54} Children, goalies and players with a past history of head injuries or concussions have been suggested as the groups most likely to benefit from its use.⁹ While the international governing body of soccer now permits the use of these products,²¹ and several leagues and soccer facilities in North America have already mandated the use of protective headgear for soccer,^{47,64} presently no national safety standard or certification process exists for protective headgear for soccer in Canada. A national standards organization like the Canadian Standards Association (CSA), should develop a national safety standard and certification process for the many headgear products that are already being sold as specific for soccer. Without a standard, the safety and effectiveness of these products cannot be guaranteed. In fact, although assuredly well-meaning, the properties of materials in some headgear designs have shown that they may facilitate transmission of energy to the brain after force has been applied.^{65,66,67} A recognized and proven national safety certification standard would allow the public to know that any certified product has met or exceeded an

acceptable level of quality and safety for soccer. A national safety standard should focus on ensuring protection against the types of contacts which result in head injuries and concussions. It should also ensure that while the headgear is designed primarily to protect the player who is wearing the headgear, it should be made of soft materials, without a hard outer shell, so it is not a danger to other players. Until such time as a national safety standard exists for protective headgear for soccer, CASM cannot endorse the use of unproven, unregulated and uncertified protective headgear for soccer.

4.0 CONCLUSION

The need to inform players, parents and coaches about fair and safe play is vital. The recommendations above are intended to decrease head injuries and concussions during participation in soccer, but recommendations are useless without education. Along with further research to improve understanding of sport related head injuries and concussions, education may be as valuable as any piece of protective equipment in preventing these injuries.

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