

Heading for Injury?

The danger of heading soccer balls remains up in the air

By DAMARIS CHRISTENSEN

Exercise promotes good health. As obesity and diseases linked to sedentary living have increased among Americans, public health officials have been urging people to take up a sport. Over the past decade, many kids and even adults have heeded this advice and started playing soccer.

The game is the most popular sport in the world and the fastest-growing team sport in the United States. It's good exercise and relatively safe, say its promoters. Some studies, however, suggest this game might not be as good for the brain as it is for the body.

Because soccer is a contact sport, a player's head frequently comes into contact with elbows, the ground, and even goal posts. What concerns some physicians and researchers is that above and beyond accidental collisions, soccer players intentionally and repeatedly take blows to the head.

Heading—redirecting the ball with one's forehead—is essential to the game. In amateur leagues, a player might head the ball six to eight times in a game, and more often during practice. The question is, Do all those bumps eventually add up to significant brain injury?

Despite the game's popularity and the possibility of head injuries, only a few researchers have looked at the effects of heading in soccer. Several small, preliminary studies now suggest that soccer players are more likely to have problems with memory and planning than are track and field athletes or swimmers. However, these studies have many flaws, their critics point out.

For example, it's difficult to isolate the effects of heading from the effects of other head injuries that soccer players suffer, says Gary A. Green of the University of California, Los Angeles School of Medicine.

Among college soccer injuries resulting from collisions with fixed objects or other players, around five percent are concussions, says Green. These temporary disruptions of the brain's function, caused when the organ is

jarred inside its protective skull, trigger symptoms ranging from mild disorientation to unconsciousness. According to the National Collegiate Athletic Association, concussions are about as common in soccer as they are in football and are more frequent than in other less contact-oriented sports.

In the other sports, however, players don't use their heads as they do in soc-

Young players encounter less force. They play with smaller balls and can't kick them as hard as adults can. Moreover, U.S. children under 12 in organized soccer are discouraged from heading in practice and games.

There are two ways heading might cause brain injury, according to Matser. If a person heads a ball properly, attacking it with the top part of the forehead, the force of the blow affects the front and back of the brain. As the head contacts the ball, the brain sloshes forward against the front of the skull, then it rebounds and hits the back of the skull.

More dangerously, he says, when a player heads a ball to either side of the forehead, slightly rotating the skull, the brain can twist on its stem. Such twisting may cause breaks in the links between nerve cells, a kind of damage known as diffuse axonal injury.

"Experience with boxing suggests that there is no question that repeated blows to the head can cause central nervous system damage," notes David A. Abwender of the State University of New York at Brockport. "Heading is a relatively minor impact, but an impact nonetheless. This may put a person at risk for very slight nerve damage, that, over time, may lead to impairment."

Not all studies support this theory. In the mid-1990s, observation of the U.S. national team and of Swedish soccer players failed to link repeated heading with any mental impairment.

Last year, however, Matser studied 53 Dutch male professional soccer players and 27 men who were track and field athletes or swimmers. Soccer players fared slightly worse on tests of memory, planning, and visual-spatial relations than the other athletes.

Among the soccer players, those who had had the most concussions fared worse on those tests than players with fewer head injuries did. Furthermore, those who played forward or defense—positions where people are most likely to head the ball—showed slightly more



Research hints that heading, especially if not done correctly, may cause mental deficits in people who play soccer for many years.

cer. Researchers have not yet determined exactly how much force a headed soccer ball puts on the brain. A full-size plastic-coated soccer ball weighs 400 to 450 grams, and a kicked ball can move as fast as 60 to 120 kilometers per hour.

While most sports physicians believe that proper heading doesn't cause brain injury, a direct, full-power blow from a soccer ball kicked by an adult has about the same force as a boxer's punch, says Erik J.T. Matser of St. Anna Hospital in Geldrop, the Netherlands.

impairment than those who played mid-field.

The most striking differences appeared in a test that required people to copy a complex figure and then draw it from memory. Compared with established standards, 7 percent of the nonsoccer athletes and 45 percent of professional soccer players had moderately to significantly impaired scores.

More recently, in the Sept. 8 *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*, Matser showed that 33 adult amateur soccer players fared worse on tests of planning and memory than did 27 swimmers or track and field athletes. In memory tests, 27 percent of soccer players had scores indicating moderately to severely impaired memory, compared with 7 percent of controls. Likewise, on the planning test, 39 percent of the soccer players rated as moderately to severely impaired, but only 13 percent of the swimmers and track athletes did.

The number of concussions an individual had suffered was inversely related to performance on 6 of the 16 tests. Roughly similar percentages of athletes in the two groups suffered concussions unrelated to soccer. Almost half of the soccer players had suffered at least one soccer-related concussion, however.

"Although [soccer-related] cognitive impairment appears to be mild, it presents a medical and public health concern since there are 200 million registered [amateur and professional] soccer players worldwide," Matser says.

"Although accidental injuries cannot be eliminated from sports, especially those involving contact, evidence of brain injury caused by a deliberate action would likely lead in a shift in attitudes towards heading," he adds.

Another small study reported at a meeting of the American Psychological Association in Boston in August suggests that a lifetime of soccer playing might lead to mental deficits substantial enough to cause problems with a person's social life or ability to perform his or her job.

Compared with a similar group of swimmers, 26 college-age men and women who had played soccer scored similarly on 11 mental tests, says Abwender. However, a group of six professional soccer players consistently fared worse on these tests than older swimmers and college-age soccer players and swimmers, he and his colleague Danielle A. Symons of the University of Florida in Gainesville reported at the Boston meeting.

Despite these results, the link between heading and brain damage is controversial. Several of the studies didn't look at a person's concussion history, so measures of mental impairment may have more to do with a prior history of concussion—either on or off the soccer field—than with head-



National soccer organizations encourage children to play soccer without heading the ball in games, but the practice hasn't been banned. Researchers haven't yet examined heading's effects on children.

ing, says Jim Moorhouse of the U.S. Soccer Federation in Chicago.

It is far from clear that deficits in performance on the sensitive neurologic tests that researchers use translate into real-life problems, Moorhouse says. No study has yet shown that soccer players are more likely than other athletes to have trouble with relationships, difficulty remembering things, or problems performing their jobs, he adds.

Jordan D. Metz of the Hospital for Special Surgery in New York agrees. "What works in a lab doesn't always hold true in real life," he argues. "I think the risk [of mental impairment] from concussion is real, but I'm not convinced by the available information on repetitive heading," he says.

However, Abwender argues, "data are starting to paint a coherent picture that playing soccer for many years can present a risk" of mental impairment.

The views are somewhat different regarding children who play soccer. "There is as yet no compelling evidence to suggest that, in the absence of frank concussion, younger soccer athletes are at particular risk for [mental] impairment," Abwender says. He is not yet convinced that heading should be banned from even youth soccer.

Some researchers disagree. Simple common sense suggests that headers should be banned among younger players, says Frank M. Webbe of the Florida Institute of Technology in Melbourne.

"I think there are enough studies out there to show something happens when you use your head as a weapon to hit the ball," Webbe says. "We still don't know whether these experimental results translate into problems in real life," he adds. "Still, if I asked you to bang your head on the wall each time you walked into your office, by and by you'd probably start to show the effects of it."

Whether or not researchers think there's good evidence that heading causes mental impairment, they all agree that the issue needs to be resolved quickly because of the game's popularity.

One specific question is, How does heading affect players who have recently suffered a concussion? Matser is undertaking a study to follow amateur and professional players over time, looking specifically at the interactions between heading and concussions.

Metz says, "Athletes who have had a concussion tend to have repeat concussions, and these can be very dangerous. One step might be to avoid putting [athletes with recent concussions] in situations where they're likely to head the ball."

Both researchers stress the importance of medical care and evaluation of players on the field when they receive a concussion. "Brain injuries are normal sports injuries, like a sprained ankle, and there should be some protocols to prevent and treat them," Metz says.

National athletic organizations should consider adopting guidelines about when a soccer player with a head injury can return to the game, he says. These rules already exist in football but not in soccer or any other sport. Yet such guidelines on concussions may be more important in soccer than in football because of heading, Green says.

Teaching proper heading technique may be an important way of reducing injuries, Green says. In one study, headaches were associated with improper heading technique.

"I think there is some evidence that headers can cause unrecognized concussion," Matser says. "When you are lightheaded or dizzy or get a headache after heading a ball, then you have a grade I concussion, and this is happening more often than we think," he says.

Matser is studying videotapes of professional and amateur soccer games to try to assess whether heading causes unrecognized concussions. Heading hasn't been studied in small children, but he suspects that repeated impacts could be doing damage to children's brains that may show up years later as "subtle deficits in skills," he says.

While Metz agrees that the issue of head injuries in soccer needs further study, he urges everyone to put the real risk of injury and the benefit of exercise in perspective. "Parents often come to me and express concern about the risks of heading a soccer ball," he says. "What I tell them is the benefits of exercise of any type far outweigh the risks of physical activity. Soccer is certainly a very safe sport."

After all, he reminds soccer moms and dads, the drive to the soccer field in their car or van is "at least 100 times" more dangerous than the game their children will play. □